The Chemical Age

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Contents

NOTICES:—All communications relating to editorial matter should be addressed to the Editor, who will be pleased to consider articles or contributions dealing with modern chemical developments or suggestions bearing upon the advancement of the chemical industry in this country. Communications relating to advertisements or general matters should be addressed to the Manager.

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Talking Bad Trade

LORD LEVERHULME never offered sounder advice than when he warned us the other day that the country will never solve its unemployment and other industrial problems by merely talking bad trade. The mere act of looking on the black side of things induces a temper of pessimism which in itself damps down energy and initiative. The truth is that, however bad conditions are, there is always one class of people who succeed in spite of them. No matter how bad trade may be there are still men who manage to do good business. They succeed because they refuse to accept failure, because when difficulties increase they call up fresh reserves to meet them, because they are resolved to create new opportunities and openings if the old ones disappear. That is the spirit that brings success, and we can take no surer step towards the good trade which everyone desires than by believing in it and working for it.

The Claude Process

THE description which Mr. J. H. West gave on Tuesday before a joint meeting of the Chemical Engineering Group and the Institution of Mechanical Engineers of M. Georges Claude's process and plant for the synthesis of ammonia is the most complete yet given in this country. By the courtesy of the Cumberland Coal Power and Chemicals Co., many of the general features and details of the process were published in THE CHEMICAL AGE of July 17 of last year. Since that time the large scale experiments have been continued and extended, and the results, according to Mr. West's account, are remarkably satisfactory. They seem to establish beyond doubt the claim that the French process is a distinct advance on the original process of Haber, which served the Germans so well during the war. At least, no one seemed to challenge the claim at the meeting. On the contrary indirect confirmation was obtained from an extremely interesting disclosure made by Dr. Harker as to the results of private experimental work in this country with which he has been closely associated. As the result of modifications of the Haber process, completely different from those of Claude, the same kind of results and yields are now being obtained in this country on a manufacturing scale.

Such an announcement naturally excited the desire of his hearers for fuller information, and in due course, perhaps, this may be divulged. It is understood that the Billingham experts have adopted a modification of the Haber process, and Dr. Harker, it is quite likely, was referring to this; the new and interesting point is that the results have reached the advanced stage he indicated. Until the details are made known it is impossible to compare the Claude process, described by Mr. West, with the improved Haber process, referred to by Dr. Harker, but, as one speaker fairly put it, the company who have acquired the British rights in the former have already sufficient faith in its merits to put all their cards on the table. It is to be hoped we shall soon have a similarly frank account of the revision which the German process has undergone from British chemists.

The meeting had one minor point of interest. These joint gatherings of the Engineering Group and the Institution of Mechanical Engineers are evidently appreciated, and some hints conveyed by Captain Sankey suggest—though here we are merely speculating—that they may have an important bearing on the proposed Institution of Chemical Engineers. Co-operation between these two bodies may be a first and valuable step towards that complete agreement on which the grant of a charter so much depends.

Acid Mixing

THE fourth of the series of special reports intended to make public results of scientific and industrial value contained in the technical records of the Department of Explosives Supply deals with "The Theory and Practice of Acid Mixing" (H.M. Stationery Office, pp. 93, 12s.). Mr. Macnab, the editor, and his staff may be congratulated on the steady progress of their important work and on the thoroughness with which each subject is treated. The present report is divided into three sections, the first dealing with acid cycles, acid balances, and control of plant output, the second with the position of the acid-mixing plant in the acids cycle and the procedure adopted in mixing, and the third with plant and process for acid mixing. A valuable feature of this as of the three previous reports is the detailed statistical information relating to processes, plant, efficiencies, &c., given in tabular and diagrammatic form. Indeed, the volume altogether is one which manufacturer, chemist and chemical engineer can hardly afford to ignore.

The report has an introductory note, in which the editor points out that in any factory engaged in the manufacture of nitrated products the acids section, which is responsible for the preparation of the mixed acids used in the nitration processes, should be organised as far as possible on rational and standardised lines. The need for a carefully regulated acids cycle is emphasised in the case of operations in which it is necessary to carry large stocks of acid in process. Instances of this kind are afforded in explosives manufacture, where the quantity of acid used greatly exceeds the bulk of the nitrated product produced. Thus, in the production of nitrocellulose, only a comparatively small proportion of the nitric acid content of the fresh mixed acid is removed during the nitration stage, and, as the report shows, the manipulation of the acid resulting from this stage furnishes an excellent example of acid balance on a large scale. Somewhat similar instances arise in the production of nitroglycerine and of TNT, and it is the purpose of the report to indicate the methods adopted in drawing up the necessary acid balances for these manufacturers.

Having arrived at a satisfactory scheme with regard to the theoretical side of the acid cycle, it is essential that the quantities stipulated in the acid balance should be realised as far as possible in practice. For the normal working of any acid factory there is an optimum position in respect of acid stocks which it is the aim of the acids manager to maintain. To attempt to control plant output by reference to the stocks alone is impossible, however, since the quantity and variety of acid in stock can successfully conceal any tendency toward over or under production until these have become pronounced; in other words, the control would pass from the acids manager to the storage tanks. Moreover, a plant will be more economically operated if the output is steady and not fluctuating from day to day or from week to week, for it is obviously unsound, both from considerations of the plant and of the operatives, for the working to be of a spasmodic or intermittent nature. An account is given in Section I. of the methods which have been devised in Government explosives factories in order to represent graphically the figures obtained from the daily stock sheets and other plant returns, so that the closeness with which the acids balance is being followed may be determined at a glance, and any deviations from schedule may be checked before they have assumed troublesome proportions.

Since the plant and process for acid mixing may be said to form the main controlling factor in the acid cycle as a whole, a detailed description of these is given, reference being made at the same time to the calculations involved in mixing acids of varying strengths to obtain sulpho-nitric acids of constant composition. This description takes the form of an account of TNT acid mixing plant at H.M. factory, Queen's Ferry, which completes the account of the TNT process at that factory, the nitration section having already been described in No. 2 of the series, "Manufacture of TNT and its intermediate products."

Nitre Pot or Ammonia Converter?

IT is probably twelve months since we referred to the use of the ammonia converter as a substitute for the nitre pot in the manufacture of sulphuric acid, and pointed to the fact that many producers showed a good deal of indifference so far as the later system was concerned. The converter has, however, now had ample time for establishing the claims which are made for it, and it would be to the advantage of all sulphuric acid makers if the minority who have operated it would give the remainder the benefit of their experience either in the form of papers or through the technical Press.

In the report of the Chief Inspector under the Alkali Acts, published during the past summer, it was mentioned that the ammonia oxidation method of supplying nitrogen oxides to chamber plants seemed to have definitely established itself, and that its use was extending. It was stated, moreover, that in the early days of the introduction of this method control was a matter of some difficulty; but as standard plants are now being made and as adjustment has been simplified, the control has become a matter of simplicity. It is satisfactory to note that although the instances where the converter is used in this country are comparatively few we have, at any rate, been more enterprising than American manufacturers. Mr. Andrew Fairlie, in a recent issue of one of our American contemporaries, points out that a choice must be considerably influenced by the fact whether or not the producer of sulphuric acid is also a producer of ammonia, for those who have to purchase the ammonia must find themselves in a far less favourable position as compared with those who have it at hand.

In the main, the most important features which those acid manufacturers who are contemplating a change from the nitre pot to the converter must consider are (*a*) the first cost of plant as compared with nitre equipment, (*b*) the comparative costs of maintaining the two systems, (*c*) comparative rates of depreciation, (*d*) the relative cost of raw materials per unit of nitrogen contained, and (*e*) the comparative efficiency of producing the oxides of nitrogen. Perhaps the *sine quâ non* of the converter system is an ability to provide an adequate and unfailing supply of nitrogen oxides, for it is a serious matter (more particularly if an Alkali Act inspector happens to be calling

at the time) if sulphur dioxide alone is temporarily travelling forward to the chambers. It would seem that as a safeguard it would always be advisable to keep nitre-potting equipment as a stand-by in case of contingencies, although in some quarters this is considered objectionable. It is points of this nature, however, which can only be threshed out by knowledge derived from practical acquaintance, and we should be glad to place our correspondence columns at the service of those who can shed new and helpful light on what we have always considered to be an important improvement in the chamber process.

The Social Centre

No one could have been present at the third annual dinner of the Chemical Industry Club last week without realising the success with which the club has established itself as the social centre of chemical industry. The dinner itself is one of the most popular and successful functions of the year, which brings together representatives of all branches of the industry, drawn from all the chemical and allied organisations, and from distant parts of the country. That in itself is a service of value, for such opportunities of friendly social intercourse are none too abundant. If the speaking this year attracted slightly less public notice than last year the explanation is that there is less occasion to-day for an offensive on Parliamentary opinion than there was when the Dyestuffs Bill was in the balance and the Safeguarding Bill seemed to have only a sporting chance of serious consideration.

Sufficient compensation for the change, however, was found in the greater attention directed to the club itself and to its domestic interests and politics. Mr. Craig, the new chairman, made out an excellent case for a greatly enlarged membership. It is no small achievement to have brought together a community of some 700 members, and to have established a comfortable home for them. Yet in comparison with the total number of persons engaged in or associated with chemical industry, that number represents a much too small percentage, and with well-directed efforts the membership ought before long to reach at least a thousand. For the moment we must be content with the considerable achievement of securing for the club official and general recognition as chemistry's one real social centre.

The presence of Dr. Stephen Miall, representing the Federal Council of Pure and Applied Chemistry, may be taken to assure that when the delayed scheme for the establishment of central chemical headquarters comes to be retaken up, the club must inevitably be one of the units to be incorporated. In the meantime it is doing "on its own" excellent service in establishing points of sympathetic contact between interests that might otherwise remain detached, in providing a common meeting ground for all members of the chemical family, and in fostering the social sense in which chemists are supposed to be deficient. "Supposed" is a necessary qualification. Good fellowship was never really lacking among chemists, but it has now found an opportunity for fuller expression in the homely atmosphere of the club—"a safe and comfortable retreat," as one speaker picturesquely put it, "in which chemists may put off the dry, wizened, applejohn character with which the world quite mistakenly invests them, and relax into the jolly good fellows they really are."

Points from Our News Pages

Special contributions relating to the use of scientific instruments include articles on "Automatic Recording and Analytical Apparatus" (Dr. Leonard Levy), "Apparatus for the Analysis of Town Gas" (J. G. Taplay), "Measuring Liquids in Tanks," &c. (pp. 652-656-657).

The main features are published of the Claude process and plant for the synthesis of ammonia, as described and discussed at a joint meeting of chemical and mechanical engineers (p. 665).

The speakers at the annual dinner of the Chemical Industry Club include Mr. Hunter Gray, K.C., Mr. Max Muspratt, Mr. A. G. Craig, Mr. Chaston Chapman and others (p. 662).

Technical problems affecting manufacturers of scientific instruments are dealt with in the Third Annual Report of the British Scientific Instrument Research Association (p. 659).

Particulars prepared by the Bureau of Standards, Washington, are given of the design and construction of laboratory apparatus for liquefying air by the Hampson process (p .668).

Our market report records a fair demand for chemicals, with a tendency on the whole for prices to become firmer (p. 679).

Books Received

PROCEEDINGS OF THE ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.

BULLETIN OF THE CLEVELAND TECHNICAL INSTITUTE. Pp. 64.

THE RIGHTS OF THE EX-SERVICE MAN AND WOMAN. By Wilkinson Sherren. London: L. J. Goodling. Pp. 111. 6d.

TECHNICAL RECORDS OF EXPLOSIVES SUPPLY, 1915-1918. Published for the Department of Scientific and Industrial Research by His Majesty's Stationery Office. Pp. 93. 12s. net.

MANUFACTURE AND USES OF EXPLOSIVES. By R. C. FARMER. London: Sir Isaac Pitman & Sons, Ltd. Pp. 116. 2s. 6d. net.

The Calendar

Nov. 29	Society of Chemical Industry (Glasgow Section): "Recent Applications of Magnesium in Synthetic Organic Chemistry." Dr. H. Hepworth.	39, Elmbank Crescent, Glasgow.
29	Sheffield Association of Metallurgists and Metallurgical Chemists: "Surface Hardening." C. L. Sumpter.	Sheffield.
30	Industrial League and Council: "Some Causes of Industrial Unrest, and a Remedy." Mr. H. H. Elvin.	Caxton Hall, Caxton Street, London.
Dec. 1	Chemical Society: Ordinary meeting. 8 p.m.	Burlington House, Piccadilly, London.
1	Society of Dyers and Colourists (West Riding Section): "The Modern Conception of the Chemical Element." Professor H. M. Dawson.	Yorkshire.
2	Society of Chemical Industry (Manchester Section): "A Note on the Direct Titration of Alkaline Manganates." Dr. J. J. Block.	16, St. Mary's Parsonage, Manchester.
7	Society of Chemical Industry (Newcastle-on-Tyne): "Chemical Works Organisation." W. B. Davidson.	Armstrong College, Newcastle-on-Tyne.
7	Royal Institute of Public Health: "Lead Poisoning in Industry." Sir Kenneth Goadby.	37, Russell Square, London.

Automatic Recording and Analytical Apparatus

By Dr. Leonard Levy, M.A. (Cantab.), F.I.C.

THE advantages of a continuous record of the variation of a particular physical condition or of the amount of a particular substance formed in a large scale reaction are very obvious. As a general rule the commercial efficiency of any reaction or process depends upon the conditions and quantities being kept continuously, as nearly as possible, to the optimum value. This may affect the quality of the desired product, and it is certain to affect the economy of the process. The person in charge of a plant can therefore control its operation by means of continuously recording instruments with a resultant efficiency which would be impossible by any other means.

The invention and usage of automatic recording apparatus is a comparatively modern development of engineering and chemical engineering practice. Very few, indeed, of such instruments were in use twenty-five years ago (if we except gas meters); yet, at the present day, they are recognised as essential adjuncts. The records obtained can be presented in various ways. The commonest are disc charts which are changed once in twenty-four hours, or long roll charts lasting for as much as sixty days. It is impossible to give within the compass of a short article anything like a complete account of the various automatic apparatus now in common usage. It is proposed, therefore, to deal briefly with the various types now available, drawing special attention to the salient features of the more novel types.

The classification of automatic recording and analytical apparatus falls readily into three fairly distinct classes :

(*a*) Apparatus for recording the variation of some physical property or condition.

(*b*) Apparatus for recording the total amount of a particular constituent which is not used in admixture with others.

(*c*) Apparatus for selectively recording the amount of one or more of the constituents of a mixture of two or more components.

It is obvious that all automatic recording apparatus must remain unaffected by changes occurring in the external atmospheric conditions. The question of compensation, if the appliance is affected by these conditions, will depend upon the type of instrument and the particular record which it is required to make.

Unless such compensation be effected, the record will be correct only in certain particular sets of conditions of atmospheric temperature and pressure. Examples of the necessity of such automatic compensation are instruments designed to record the heating power or the specific gravity of gaseous mixtures. The recording calorimeters and gravitometers, to which attention is directed below, may be studied with advantage from this point of view.

(A) Apparatus for Recording the Variation of a Physical Property or Condition

Instruments for this purpose are now very numerous and are or can be made to cover practically every field. The most important types of this class are :

(1) Recording thermometers and pyrometers.
(2) Recording pressure gauges.
(3) Apparatus for recording the specific gravity of gaseous mixtures.
(4) Recording gas calorimeters.
(5) Apparatus for recording the specific gravity of liquids.

(1) *Recording Thermometers and Pyrometers* are now used for innumerable purposes. Various types of electrical pyrometers are most commonly employed, three distinct types of which are made by the Cambridge and Paul Instrument Co. to cover all ranges of temperature variation.

Electrical resistance thermometers are employed for temperatures from minus 200° to plus 500° C. The *modus operandi* of these instruments depends upon the variation in the electrical resistance of a platinum wire with the temperature to which it is exposed. This platinum wire forms one arm of a Wheatstone Bridge and any increase in temperature above the zero of the instrument causes a current to flow through a recording galvanometer which is calibrated to record the temperature.

Thermo-couples are employed for the measurement of higher temperatures up to 1,200° C., the material of the couple depending upon the range. The E.M.F. generated is registered by a suitable recording millivoltmeter.

Radiation pyrometers of the Féry or similar type are employed for recording temperatures above 1,200° C. In these instruments a telescope is focussed on the hot body, the rays being received on a concave mirror and brought to focus on a small thermo-couple. The E.M.F. produced by the consequent heating of the junction is recorded on a millivoltmeter calibrated to give the direct readings in temperature.

In addition to the electrical type of recording thermometers, there are other types which function by the change in pressure experienced by a confined substance which is exposed to the changes in temperature; this concomitant change in pressure being recorded by a suitable recording pressure gauge, which is calibrated to read directly in temperature.

For example, a steel bulb is filled with mercury and connected by steel capillary tubing—also filled with mercury—to a recording Bourdon gauge, which is actuated by the expansion and contraction of the mercury.

Another type which finds extended usage consists of a copper bulb filled with nitrogen under pressure, the expansion or contraction of which serves to actuate a recording Bourdon gauge. Owing to the nitrogen being under considerable pressure the recorder is practically unaffected by variation in atmospheric pressure.

(2) *Recording Pressure Gauges.*—These instruments are made in three main types according to the degree of pressure which is to be recorded. In cases where the total pressure is very small indeed, and it is required to record minute differences, communicating chambers containing water, liquid paraffin or mercury are employed. The difference in level is imparted to the recording mechanism by the movement of a float in one of the chambers. In cases where the total pressure is small, the well-known diaphragms of the aneroid type are employed. These diaphragms expand with the application of pressure and this expansion is amplified by a system of levers actuating the recording pen. The sensitiveness of this type can be increased by employing a larger number of diaphragms.

These instruments are employed as barographs for meteorological observations, as altitude recorders in aeroplanes and for many other purposes.

In those cases wherein the pressure to be recorded is considerable the well-known Bourdon tube gauge is employed. This type of gauge is, generally speaking, not employed for pressures below 4 lb. per sq. in.

(3) *Apparatus for Recording the Specific Gravity of Gases.*—Only a few years ago there was no instrument in existence for recording with accuracy the specific gravity of gases and gaseous mixtures. The Lux gas balance (in which a globe filled with gas, owing to variation of its displacement, caused a pointer to move over a graduated scale) gave indications of specific gravity uncorrected for temperature and pressure. It was valueless as a recording instrument even supposing that a sufficiently delicate pen mechanism could be devised.

The invention of the gravitometer by Mr. J. F. Simmance enabled the specific gravity of gaseous mixtures to be recorded with any desired degree of accuracy.

In this instrument (a diagram of which is given in Fig. 1) the gas, the specific gravity of which is to be recorded, is led continuously in a slow stream over a delicately suspended aluminium bell. A tube placed above the bell is also filled with gas to the top. The effect of this construction is that the pressure exerted upon the top of the bell differs from that exerted when no gas is passed by the difference between the weight of a column of air and the weight of a column of the gas of diameter equal to that of the bell and height equal to that of the tube.

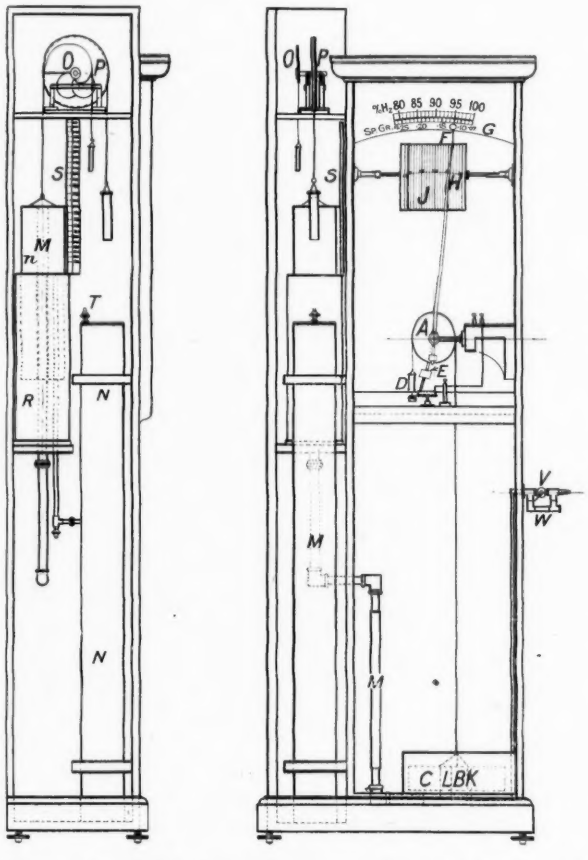


FIG. 1.—HYDROGEN PURITY RECORDER FOR AIRCRAFT WORK. SIMMANCE'S PATENT GRAVITOMETER.

As these dimensions can be made large if required, it is obvious that a small change in specific gravity can be made to represent a considerable change in the actual weight applied to the surface of the bell. The instrument is thus very sensitive. The variation in the weight applied to the balanced bell causes it to rise or fall and so to actuate a pen mechanism working over a suitable graduated chart carried by a clock. As the actuating force is the difference between the weights of two columns of gas and air of equal size, it will obviously vary with changes of atmospheric temperature and pressure, and thus the record will be vitiated unless these changes are automatically compensated.

The necessary correction is applied in the following manner. Instead of having a tube of fixed height over the balanced ball, the top portion of the tube is loose and is connected by a balanced arm to a freely suspended chamber containing air and sealed in liquid.

Variation in atmospheric temperature and pressure occasion concomitant variations in the volume of the air contained in the suspended chamber, which, therefore, moves up or down and thus alters the level of the loose tube connected to it. This in effect increases or diminishes the height in proportion to the degree of variation of atmospheric conditions, and the arrangement is so adjusted that the difference in the weight is kept constant over all variations likely to be experienced in practice.

Very delicate instruments of this type were used during the war for controlling the manufacture of hydrogen for airships. The diameter of the bell employed was 8 in. and the height of the column was 52 in. 0.01 specific gravity was represented on the scale by a length of $\frac{3}{8}$ in. and the actuating weight representing 0.1 specific gravity is 6.5 grams. This clearly indicates the extreme sensitiveness of this instrument.

Recording specific gravity apparatus find special application in gasworks.

(4) *Recording Calorimeters.*—These instruments have assumed a greatly increased importance owing to recent legislation in connexion with the sale of coal gas whereby gas is charged for according to its heating value and not by its volume as hitherto.

In this instance, therefore, accuracy, reliability and insensibility to external changes are of paramount importance.

The calorific power of gaseous mixtures is expressed in terms of thermal units per cub. ft. measured under standard conditions. Any satisfactory recording device must, therefore, automatically vary the volume of gas delivered to suit the prevailing conditions, so that the volume delivered, if corrected for temperature and pressure, will always be the same.

In addition to this the flow of the gas through the orifice of the burner will be affected by its specific gravity, and therefore, in addition to the temperature and barometric correction, an adjustment for this variation must also be automatically effected. This automatic delivery of a standard quantity of gas under all conditions is the chief difficulty in connexion with the production of an accurate recording calorimeter.

The actual measurement of the heat of combustion may be made in a variety of ways. The problem has been solved in two different types of recording calorimeters designed by Mr. J. F. Simmance.

The gravitometer is employed as a governor to control the flow of gas to the burner and is actuated by the variation of the specific gravity of the gas itself as already explained. Instead of employing the movement of the bell to actuate a pen, it is used to open or close a valve controlling the supply of gas to the burner. The correction for the effect of temperature and barometric changes is also effected by the same control.

The heat of combustion in the " calorgraph " is recorded by means of a differential air thermometer composed of two exactly similar diaphragms working in opposition on the same rod, the movement of which is employed to actuate the pen gear.

In Simmance's recording calorimeter the controlled volume of gas is burned in an ordinary calorimeter of the flow type. This can be used as it stands for hand tests, and in addition a continuous record is obtained by immersing the bulb of a differential recording air thermometer in the inlet and exit water streams.

There are a number of very important subsidiary points in the design of recording calorimeters, such as the maintenance of an absolutely constant water supply and keeping constant the water level of the wet meter. These difficulties have been quite overcome and either type of instrument will give an accurate record for long periods without attention.

(5) *Specific Gravity Recorders for Liquids.*—These instruments are actuated by the varying displacement of a solid body which is totally immersed in the liquid. It is obvious that this arrangement is affected by temperature. A recording thermometer is included in one type of this instrument so

that the record of specific gravity can be considered in conjunction with the temperature of the liquid which is simultaneously inscribed on the same chart.

Specific gravity recorders, in which an automatic temperature correction is applied, have been made to the design of Mr. J. F. Simmance, but are not at present on the market.

(B) Apparatus for Recording Total Quantities

Very important appliances of this type are water meters, which are employed for measuring and recording boiler feed water, pump deliveries, water supplies, trade effluences and numerous other liquids.

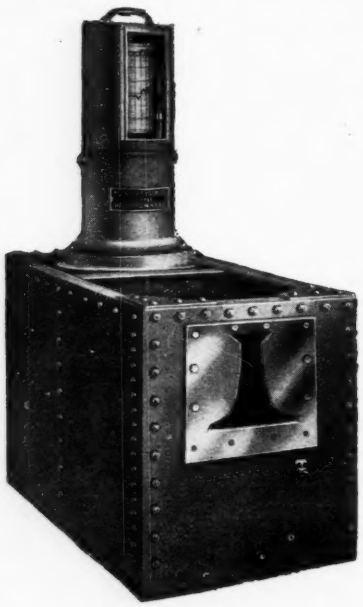


FIG. 2.

These instruments are actuated by the varying head of liquid when flowing over a weir fixed in the end of a tank. The rate of discharge through a rectangular or V-shaped notch or weir is expressed by the formula :

$$Q = CA\sqrt{h}$$

Q = rate of discharge.
A = submerged area of weir.
h = head.
C = the constant.

Various water flow meters are made in which the V-shaped weir is used, but as the flow is proportional to the square root of the head (and not to the head itself), compensation devices are employed in order to produce a record on a uniformly divided scale.

The problem has been solved in a different way in the " Precision " water meter, in which the weir has a breadth inversely proportional to the square root of the corresponding head, with the result that the latter is directly proportional to the flow. An evenly divided chart is thus rendered possible without any mechanical application between the float and the pen.

Fig. 2 gives an illustration of a typical weir of this design.

The rate of flow is recorded on a chart, and the total flow can be computed by obtaining the area of the diagram so recorded by means of a planimeter.

An integrating device can also be fitted so that the total flow during any period is automatically added up and registered on the index in plain figures.

In the case of gases, the various types of gas meters are instruments for recording the total quantities, the record being read from indices instead of being inscribed upon a time chart.

(C) Apparatus for Selectively Recording the Amount of One or More of the Constituents of a Mixture which Varies in its Component Quantities

The specific gravity recorder referred to above may, perhaps, be considered to be of this type when employed to determine the composition of a liquid mixture or solution, if the variation of one of the components is a direct function of the specific gravity.

Apart from this, selective recording gas analysers afford the only examples of this class. These instruments are continually finding further uses, and it is quite certain that they will find still more extended application as time progresses.

The well-known CO_2 Recorders are by far the most extensively employed types of automatic analysers. These are used for the control of furnaces and power plants of every description. It is now a matter of common knowledge that the fuel consumption is reduced to a minimum for a given production of power if the percentage of carbon dioxide in flue gas is kept as near to a certain maximum as possible.

The usual limits prescribed for successful working are 12 to 16 per cent. CO_2, and in all well-conducted plants the stoker is obliged to tend his fires so that the CO_2 is maintained within prescribed limits.

Fig. 3 illustrates diagrammatically the economy effected by correct stoking controlled by a CO_2 Recorder, and is illustrative of the value of these instruments.

The waste of coal due to low percentage of CO_2 may also be expressed by the following table, which sets out in another way what the diagram shows graphically :

Percentage of CO_2	16	15	14	13	12	11	10	9	8	7	6	5	4	3	per cent.
Loss in fuel.. ..	10	12	13	14	15	16	18	20	23	26	30	35	45	60	per cent.

It will be noted that 10 or 12 per cent. loss is unavoidable owing to the impossibility of discharging the flue gases at atmospheric temperature, but the diagram and the table both show that the fuel loss increases as percentage of CO_2 decreases.

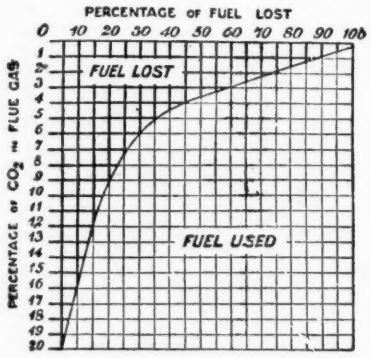


FIG. 3.—STANDARD DIAGRAM SHOWING HOW FUEL LOSS INCREASES AS PERCENTAGE OF CO_2 DECREASES.

There are several well-known types of CO_2 Recorders on the market, and the choice of a particular type will depend upon a variety of considerations. As these instruments have to be used by engineers who often have no experience of delicate appliances, it is obvious that apparatus of robust type, simple in its action and with few or no glass parts, is eminently desirable.

The most widely used types of CO_2 Recorders function by inspiration of a fixed volume of the flue gas which is remeasured after the CO_2 has been removed by absorption. The volume removed is recorded as a percentage of the total volume. The analyses are effected so rapidly that a

continuous record is obtained. No temperature or pressure corrections are necessitated as measurements both before and after absorption are effected under the same prevailing conditions ; as in the case of a constant pressure gas analysis made by hand. The heat of absorption of the carbon dioxide must of course be entirely dissipated before the re-measurement is effected.

Selective recording analysers are now constructed and are in general use for recording sulphur dioxide, chlorine and other easily absorbed gases. The construction of these instruments necessitates certain changes in design with respect to the materials with which the gases come into contact, the sealing liquids, &c. The absorbent employed must also be chosen to suit individual gases ; for example, caustic potash could not be employed for sulphur dioxide if carbon dioxide were also present.

Sulphur dioxide recorders find application in the sulphite pulp industry, and chlorine recorders in connexion with a variety of chemical processes in which this gas is employed.

A selective gas analyser of new type has recently been perfected for recording carbon monoxide, for the design of which the author pleads guilty. The latter gas in this instrument is selectively oxidised to carbon dioxide at ordinary temperatures and is then recorded as carbon dioxide.

The instrument is quite accurate if carbon dioxide be absent or is present in amount which does not vary more than about 1 or 2 per cent. If, however, carbon dioxide may be present in variable quantity a combined CO and CO_2 Recorder is required in which the percentage of both these constituents is accurately recorded.

Such appliances should find extensive use in connexion with producer and water gas plants, and may also be employed for the automatic analysis of blast furnace gas.

Selective recording gas analysers can be made to record an analysis at any required interval by simple adjustments of the actuating mechanism, a speed of one analysis per minute can usually be obtained if required. The accuracy of the record is usually well within plus or minus 0.2 per cent.

This survey of the various types of recording apparatus is necessarily very incomplete. As a general rule special appliances have only been referred to in cases where they are the only ones of their kind or if they embody novel features. In very many cases increased use of automatic appliances will lead to much greater efficiency of working and power costs.

The author is indebted to Messrs. Alex. Wright & Co., Ltd., for information concerning their various recording instruments and automatic analysers, and to the Cambridge and Paul Instrument Co., Ltd., for information concerning their recording pyrometers.

A New Laboratory Appliance

A. GALLENKAMP & CO., LTD., of 19 and 21, Sun Street, Finsbury Square, E.C. 2, have placed on the market a new laboratory appliance known as the " Leadacrack " glass tool, for which an application for a patent has been made. This device is designed to replace the hot glass rod used for starting and leading cracks in glassware, and consists of a fine platinum tube of very fine bore suitably mounted. When connected to the gas supply and lit the platinum tube gives a very small pointed flame, which, it is claimed, effectually replaces the hot glass rod commonly used. It has the great advantage that it is always small and pointed and unlike the glass rod does not cool. If, for example, a large diameter glass tube has to be divided a nick is cut with a file in the usual way ; starting from this nick a line is brushed with the flame completely round the tube before attempting to start a crack. This treatment ensures that the crack when started will follow the desired path. The brushing operation can be repeated till the crack starts, care being taken that the line heated is the same as before, or once the glass is sufficiently hot a small cold object placed on the nick will start it. If the crack does not extend all round the tube, it can be led with the flame. In a similar way broken glass apparatus can be trimmed and put to fresh use.

The "Microscopic Micrometer"

A New Canadian Measuring Instrument

AN instrument primarily designed to demonstrate the conditions as met with in the work of fine separation was exhibited at the recent Chemical Exposition in New York, and is described briefly in *Canadian Chemistry and Metallurgy*. According to our contemporary, it has attracted a large amount of favourable comment, and owing to requests to duplicate the instrument for research laboratories, general microscopic measurements, &c., it has been decided to manufacture it commercially. The name indicated as being suitable for this instrument is " Microscopic Micrometer," it being claimed that it is accurate in measurements of particles or bacteria as fine as .000025 m.m. and with the use of vernier to .0000025 m.m.

The general principle of this instrument is to have a moving stage operated by a micrometer screw to pass from side to side between a finely etched line in the eyepiece and to be used in connexion with either dry or oil immersion objectives. There is connected to the stage a rotary sub-stage for centring specimens. This is actuated by the use of the worm and worm wheel built in and operated through a thumb wheel.

In the chemical field, states our contemporary, it might be put to the examination in measurements of crystalline substances when the chemist is endeavouring to reproduce a compound made up of numerous elements. It can be readily understood that through quantitative analyses the exact proportions of different elements might be slightly in error. If, however, the chemist understands the general microscopic structure of the elements which he may be using, he can readily tell by the size of the original crystals he is endeavouring to reproduce whether or not he has too much or too little of any of the elements in his reproductions. It has also been suggested that an instrument of this kind will prove very satisfactory and helpful in the pigment industry, wherein objects almost colloidal could be measured with accuracy. It is supposed that it might be stated that the instrument, because of its extremely fine adjustment, would measure anything which can be seen through the most powerful objective. The inventor of the instrument is Mr. A. A. Campbell of the Newark Wire Cloth Co., Newark, N.J.

Swiss Scientific Instrument Trade

DISCUSSING Switzerland as a market for scientific instruments, the American Consul at Berne, in a recent report, states that it is as well to note that Germany sent (in value) nearly twice as many instruments of precision into Switzerland in 1919 as in 1913. The value of these German instruments was not intrinsically great, being 217,431 and 112,135 Swiss francs for 1919 and 1913 respectively, but the total imports for all countries only amounted to 224,560 francs for 1919 and 131,704 francs for 1913. He says that Switzerland has now become aware of the profitableness of manufacturing certain scientific instruments for domestic use and for export, and advances in support of this contention that scientific instruments to the value of 3,422,626 francs were exported to France in 1919. Another significant fact is that of this apparatus Switzerland exported in 1919 over twenty times as much as in 1913, or 4,481,765! francs, as against 203,891 francs' worth. In conclusion he states that the market must necessarily be a difficult one to enter on account of strong German competition and the recent impetus given to domestic manufacture.

British Cast Iron Research Association

IN its monthly report, just issued, the research department of the British Cast Iron Research Association state that members have submitted a number of problems which are now being investigated by the Director of Research. Among the subjects under investigation are pyrometers in foundry work, causes of fracture in heavy grey iron castings, defects in malleable iron castings, and the remedy ; difficulties in cupola practice when melting white iron, and means for minimising of the trouble. Researches are being carried out by the Association upon sulphur holes and hard spots in castings ; standardisation of testing methods of cast iron ; cupola and ladle linings, moulding sands, and alloys of cast iron for resisting erosion and corrosion in centrifugal pumps, valves, pulverisers, &c.

Apparatus for the Analysis of Town Gas

By J. G. Taplay

THERE are many forms of apparatus in use for the analysis of town gas. Some of these deal only with the determination of the absorbable constituents, while others are designed to determine, in addition, the constituents of the gas mixture which are unabsorbable.

In regard to the absorbable constituents, forms of apparatus are used such as the Hempel, the Bünte, the Orsat and others, all of which are used in connexion with constant pressure apparatus.

Another form of absorption apparatus is that connected with the Frankland or the Bone and Wheeler, which are of the constant volume type.

With care, the determination of the absorbable constituents is not one of very great difficulty, but when the determination of the residual gases, hydrogen, methane and nitrogen, is attempted, their respective volumes are not so easy to ascertain.

In the past, and even at the present time, the usual practice on the determination of the volume of the residual gases is by explosion with air or oxygen, or a mixture of both. For this purpose the author has employed the Hempel explosion pipette, which is globular in form, the Elliott explosion burette, which is a little over 2 ft. in length and nearly $\frac{3}{4}$ in. in diameter, and a special burette about $4\frac{1}{2}$ ft. long and $\frac{5}{8}$ in. diameter.

When exploding mixtures of known volumes of hydrogen, methane and nitrogen with oxygen or air or a mixture of both, the special burette gave the nearest result to the truth. The Hempel burette gave a result which was quite unreliable, the reason being that owing to its shape the combustible gas was extinguished before it was completely burned—the result being that the apparent volume of nitrogen was increased owing to the presence of unburned methane.

In the case of the special long explosion burette, when the mixture of combustible gas and air or oxygen was fired, the flame travelled slowly from the top to the bottom, and very good results were obtained, but unfortunately this form of apparatus is ungainly.

With the Elliott form of apparatus the figures obtained were variable and conflicting—many explosions of the gas mixture giving widely different results.

The experience of the author and other experimentalists in explosion methods is that these have been accompanied by the separation of hydrogen, carbon monoxide and free carbon, due to dissociation of water vapour and carbon dioxide, caused by the high temperature of the explosion; and even formic aldehyde has been found in the combustion products, which should consist solely of carbon dioxide and water. Explosions of gas with air have resulted in finding hydrogen in the products due to imperfect combustion—all this notwithstanding the gases had been previously well mixed.

Explosions of this kind would, of course, influence the volumes of the three residual gases. Moreover, the greater the amount of nitrogen in the combustible gas, the more difficult it is to obtain perfect combustion of the hydrogen and methane. Again, perfect combustion of the hydrogen and methane has been attended by a partial combustion of the nitrogen to nitric acid.

It is also well known that the form of the explosion vessel, as already pointed out, has an influence on the combustion of gas mixtures, and that gas mixtures of widely differing composition behave differently in the same explosion vessel. Such conflicting results can be obtained with the same sample of gas that it is impossible to determine which are the correct figures without having recourse to an investigation into the nature of the combustion products; and this must be done with any given type of gas before it is possible to determine the conditions that will give a reliable result, which is, to say the least, a tedious process.

To overcome the difficulties attendant on the explosion method, the author constructed an apparatus, during the year 1912, whereby combustion of hydrogen and methane was effected by passing the residual gas over heated cupric oxide, the volume of the former being determined by contraction. The nitrogen, however, had to be swept out of the combustion tube by a stream of carbon dioxide which was absorbed by caustic potash solution and the nitrogen was measured. The volume of residual gas being known, it will be apparent that the methane is the difference between the total gas taken and the sum of the hydrogen and nitrogen volumes.

The cupric oxide in this particular apparatus was what is known as the " wire " form.

The more modern apparatus devised by the author and exhibited at the National Gas Exhibition in September, 1913, has certain advantages over the older form mentioned above. This later apparatus was designed for a complete analysis of the gas—that is to say, for the determination of the absorbable constituents of the gas—carbon dioxide, olefines, benzene vapour, oxygen and carbon monoxide; and also for the determination of the non-absorbable constituents—hydrogen, methane and nitrogen.

The apparatus was designed as a constant pressure one, but it may be just as easily adapted to a constant volume in type, if desired. The confining liquid in this apparatus is mercury.

The salient feature of this apparatus, as compared with the older form, is connected with the combustion of the residual gas. Instead of using cupric oxide in the " wire " form and having to employ a " gas-sweep " of carbon dioxide, the author now uses a rod, supported in a silica tube by loops of silica. This rod is composed of finely-ground cupric oxide mixed with a matrix of kaolin (China clay) and baked at a red-heat.

After combustion of the residual gas, the combustion tube is cooled and the remaining carbon dioxide and nitrogen is swept out by means of mercury into the potash pipette where the carbon dioxide (resulting from the combustion of the methane) is absorbed, leaving the nitrogen which can be measured. The hydrogen is, of course, determined by contraction in volume.

If it is desired to determine carbon monoxide by combustion instead of by absorption, this constituent is left in the residual gas and a combustion over the copper oxide rod is made at a comparatively low temperature, say, 280°C. At this temperature the hydrogen and carbon monoxide will be burned, but the methane will be unaffected. The hydrogen volume will be determined by its contraction and the carbon monoxide by the volume of carbon dioxide produced.

When examining natural gases ethane is often found, together with hydrogen, methane and nitrogen. In such a case the gas is passed over the copper oxide rod at a temperature of about 280°C, and the hydrogen volume is determined by contraction. The gas is then passed over the rod once more at a bright red heat when the ethane and methane are oxidised to carbon dioxide. The methane produces its own volume, but the ethane produces twice its volume of CO_2, consequently it is very easy to determine the proportion of ethane in the gas mixture.

If the calorific value of a combustible gas is to be calculated from the results of the analysis it will be necessary to determine the carbon and hydrogen densities of the olefines present in the gas. To effect this it is necessary to make a combustion of the gas as a whole, that is before removing the absorbable constituents. By this means the total CO_2 produced by combustion is obtained, and from that figure expressed as a percentage the sum of the CO_2 produced from all the

constituents except the olefines is deducted. The residual CO_2 is divided by the percentage volume of the olefines found, the resultant figure expresses the carbon density; the hydrogen density being taken as twice that of the carbon.

This apparatus has been successfully employed for the examination of motor spirits. In this case a small drop of the motor spirit has been introduced, together with nitrogen, into the measuring burette, and a combustion made, the resultant CO_2 being measured.

The amount of oxygen which the rod will afterwards absorb is also noted, and from these two observations the carbon and hydrogen densities of the spirit can be determined. The latter serves to identify its nature.

Powdered Slate

To the Editor of THE CHEMICAL AGE.

SIR,—In your issues of November 5 and 12 reference is made to the above substance, and in your editorial note (p. 548-9) you lay down that 99 per cent. must pass a screen of 300 mesh. This would be a most difficult job unless the inherent properties of the material slate and its impurities have had careful and complete study in all stages of its supply and preparation.

As a filler its specific gravity is high and its content of iron, lime, magnesia, and alkalies is also high. Great care must be taken in the selection of the raw material, especially when you pass the 100 mesh line of final size. Screening, unless properly carried out, is an expensive item, due mainly to angularity of the particle and its great affinity for moisture. A study of slate will aid the engineer in his investigations of steel applied to turbine reduction gearing.—Yours, &c.,

November 18. ADVANCEMENT.

Prevention of Corrosion

To the Editor of THE CHEMICAL AGE.

SIR,—It is as well that those contemplating the use of grease as a protection for ferrous metals, especially the "carbon" ones, should watch the acid contents. As a general rule, a plain cement wash is an excellent preservative for iron, steel, &c., if the cement is good and it is properly applied. In chemical and such-like works this matter is best served by the old man's dictum, "Do it because you should, and not because you must." As corrosion will be sure, inspection also must follow, as a system, not as an accidental duty.—Yours, &c., T. J. M.

November 18.

New Steamship Service to Australia

STEAMSHIP communication with Australia will be still further improved by the inauguration of a new service of big fast vessels specially built for the Commonwealth Government Line. They have ample passenger and cargo capacity, and by omitting Mediterranean ports will accomplish the voyage in at least three or four days less time than any other line to Australia. Five new steamers of uniform register of about 14,000 tons and of rapid speed have been built. Each bears the name of an Australian coastal bay—Moreton Bay, Largs Bay, Hobsons Bay, Jervis Bay, and Esperance Bay—being thus representative of the five largest states of the Commonwealth. They are built to uniform design and are fitted with up-to-date appliances to ensure rapid and safe handling of cargo, of which, owing to size of hatches, nature of gear, &c., all classes can be carried. Lowest current rates of freight will apply to and from Colombo as well as Australia. Passenger accommodation is of the most modern type. Only a small number of 1st saloon passengers will be carried, the bulk of the room being available for 3rd class to a total of over 700, in two, four, and six-berth cabins. The *Moreton Bay*, the pioneer of the new line, is timed to leave London on December 7, and the other ships of the "Bay" class will follow her at four-weekly intervals. They will proceed direct from London to Port Said, thence to Colombo and Australia, calling in turn at Fremantle, Adelaide, Melbourne, Sydney, and Brisbane, the terminal port.

Measuring Liquids in Tanks

The Pneumatic Method

THE problem of measuring the contents of tanks in an accurate and convenient manner is one to which a great deal of thought and ingenuity has been paid, but many of the methods adopted have been found to possess distinct disadvantages where accuracy was the main requirement. Sounding rods, in addition to being inconvenient in use, cannot be employed where the tanks are under pressure or vacuum.

The latest development in this connexion is a system, the operation of which is based on the maintenance of a true hydrostatic balance between the head of liquid to be measured and a column of mercury, or other indicating medium, the pressure being transmitted by air confined in a small connecting tube between the balance chamber and the gauge. It is claimed for this system that the registering portion of the instrument can be located at any distance above or below the tank; that its accuracy is not affected by changes of temperature; that it works equally well on tanks open to the atmosphere, under vacuum or a varying pressure; and that it provides in itself the means of proving the reliability of its readings. In addition to indicating the liquid head the gauge can be calibrated to give a direct reading of the weight or volume corresponding to a liquid head.

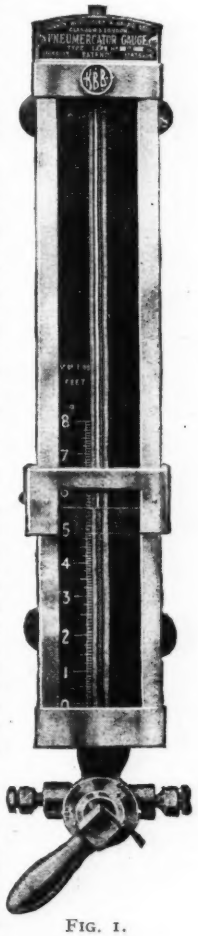


FIG. 1.

The essential parts of the apparatus are: (*a*) the balance chamber; (*b*) the mercury (or other) gauge (see Fig. 1) which is calibrated in feet and inches of liquid depth and/or in the corresponding weight or volume; (*c*) the air pump or other means for furnishing compressed air; (*d*) the control valve directly attached to the gauge and also connected through piping with the balance chamber and air pump; and (*e*) small solid-drawn air piping, which may be of any length, may pass through boiler rooms, refrigerators, &c., may be laid indoors or out, and in any direction.

In this apparatus, which is patented, and is known as the "Pneumercator" tank gauge, the balance chamber is generally a more or less hemispherical vessel provided with a sharp-edged orifice which determines the datum level near its base. It is placed as near as possible to the bottom of the tank containing the liquid. The head of liquid in the tank compresses the air trapped in the balance chamber, and the pressure is transmitted by the small connecting air pipe to the gauge, causing the mercury column to rise and fall as the pressure due to the head of the liquid in the tank increases or decreases.

The air pump is used to ensure that the level of the liquid in the chamber corresponds with the datum level. Before a reading can be taken, therefore, a sufficient quantity of air must be pumped into the balance chamber to expel any excess liquid through the orifice and to drive the level of the liquid in the chamber down to that of the datum line (see Fig. 2).

The level of the liquid inside the chamber cannot be driven below the datum line, as any excess air put in by the pump escapes, as shown in Fig. 2.

This done, the pressure of the air in the balance chamber and pipe line exactly balances the pressure of the height of the liquid in the tank above the datum level. The control valve connects the balance chamber with the air pump, or shuts off the air pump, and connects the balance chamber to the gauge; it will also disconnect all three elements when required. Fig. 3, an illustration of the balance chamber and gauge in a simplified form, shows the trapped air in the chamber compressed by the head of liquid in the tank.

By placing the control cock at "vent" the zero of the instrument may be checked at any time, while the correct maintenance of the datum level is ensured by the operation

of the pump before taking a reading. If insufficient air has been pumped in before the reading is taken, the fact is disclosed by a repetition of the operation, when a higher reading on the gauge will be obtained.

Measurement, when the storage tank is under pressure or vacuum, is rendered possible by running an additional line of small air tubing from the top of the tank to the top of the indicating mercury column, so that the pressure per square inch of the air, gas or vapour at the top of the tank acting (in addition to that of the liquid head) on the base of the mercury column is counter-balanced by a similar pressure acting in the upper surface of the column. Thus the height of the mercury column is determined solely by the depth of liquid in the tank.

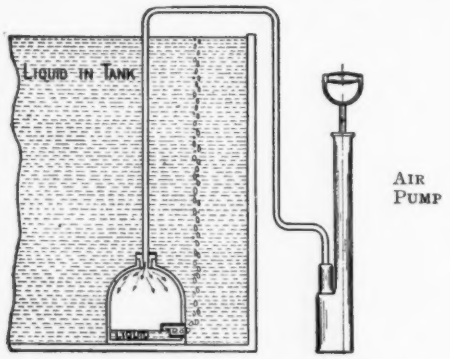


FIG. 2.—LIQUID IN BALANCE-CHAMBER RESTORED TO ITS DATUM LINE.

When desired, an annunciator can be attached to the tank gauge to indicate predetermined maximum, minimum, mean, or other levels. The mercury in the instrument makes and breaks its own electric connexions at the point determined upon, thereby operating an indicator shutter on the annunciator and ringing an alarm bell. The only wiring necessary is between the mercury columns and the annunciator. The annunciator does not necessitate diaphragms, floats or electric circuits of any kind in or near the tank.

Kelvin, Bottomley and Baird, Limited, of 18, Cambridge Street, Glasgow, who are the sole manufacturers of this apparatus for Great Britain and Europe, inform us that the "Pneumercator" tank gauge is regularly used for measuring a wide variety of liquids, including fuel oil; tar oil; paraffin oil; crude oil; tempering oil; petrol; benzol; alcohol; methylated spirits; cottonseed oil; castor oil; linseed oil; olive oil; ether; liquid ammonia; vinegar; molasses; sulphurous acid; sulphuric acid; phosphoric acid; nitric acid; caustic soda; brine solution; bleach liquor; and fresh water.

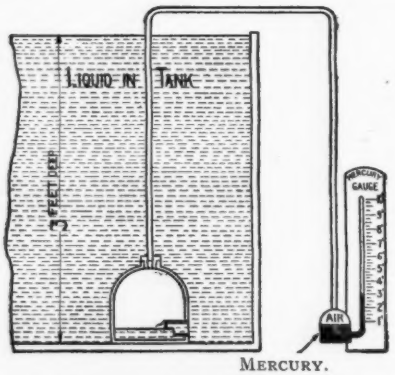


FIG. 3.—TRAPPED AIR IN BALANCE-CHAMBER COMPRESSED BY HEAD OF LIQUID IN TANK.

Each outfit is made up for the specific purpose for which it is to be used, special outfits being arranged to suit any acid. A demonstration outfit may be seen in operation at the manufacturers' premises in London, Newcastle-on-Tyne and Glasgow. The firm also manufacture a new gravity gauge which, they claim, enables the system to be applied to the measurement of the specific gravity of the contents of a tank at a distance, and permits of the reading of such specific gravity to the third place of decimals.

The gravity gauge measures in effect the pressure head of a column of the liquid of a known and fixed height. The pressure head of such a column of known and fixed height depends only on specific gravity, and the gauge may, therefore, be calibrated direct in specific gravity. It is used in conjunction with a special duplex balance chamber from which the pressures of the liquid at two levels 3 ft. apart are led back to the compound gauge.

Chilean Nitrate Industry

Official Review of Current Conditions

H.M. Consul at Antofagasta, writing to the Board of Trade, states that the production of nitrate during the first six months of the current year amounted to 18,544,943 quintals, making a total production for the nitrate fiscal year ended June 30 of 47,263,030 quintals, compared with a total production in the previous year of 42,549,379 quintals. Exports of nitrate during the past fiscal year amounted to 44,576,839 quintals, as against 47,974,649 quintals in the previous year.

Stocks of nitrate at June 30 were approximately as follows:

	Tons.
On the coast and afloat	1,452,000
In Europe and Egypt	858,000
In the United States of America	200,000
	2,510,000

or about, say, 55,000,000 quintals, and the output for the month of June was 2,080,000 quintals. A normal year's consumption before the war was generally estimated at from 40 million to 50 million quintals.

Of 142 nitrate factories ninety-three had closed down on June 30, and it is difficult to understand the reason so many continue working, although they are doing so at a very reduced capacity. It is not unlikely that many more will have to close down in the course of the year as the nitrate situation is about as bad as it can be. The factories working in the Antofagasta district belong mostly to Jugo-Slavs, and have continued working, it is reported, at the special request of the Chilean President and with State aid, in order to ease the unemployment question; presumably, however, this cannot continue much longer.

The severest sufferers from the critical situation are the Government, who are dependent, to the extent of 70 per cent. of the total revenue of the country, on nitrate duties, and, in the second instance, the unemployed, most of whom have again been sent to the South, this making the third occasion since 1914 that they have had to be transferred, and under conditions that few workmen would put up with in any other part of the world.

In conclusion, the Consul states that the majority of the nitrate companies made large profits during 1920, owing to the high prices paid by the "pool," and could afford to have meted out better treatment to their employees, even after making allowance for the putting by of reserves to tide over the crisis.

Tenders Invited for Chemical Products

THE Argentine State Railways recently called for tenders for one year's supply of chemical products, to be presented on October 17. The Department of Overseas Trade is informed that fresh tenders for these goods are now invited by January 2. The Commercial Secretary to H.M. Legation at Buenos Aires has stated, in regard to these tenders, that in view of the complicated conditions and the terms of payment, it will probably be preferable for United Kingdom firms interested to quote to their existing connexions among local merchants who cater for this class of contract rather than put in a tender direct through a commission agent. A copy of the relative conditions and specifications (in Spanish) can be seen by United Kingdom firms interested on application at the Department of Overseas Trade (Room 94), 35, Old Queen Street, London, S.W. 1, until November 30, after which date the documents will be available for firms in the provinces unable to arrange for their inspection in London.

British Scientific Instrument Research Association

Third Annual Report

The third annual report of the British Scientific Instrument Research Association gives a brief account of the development of the Association and of the researches now in progress. Extracts from the report are given below.

THE council are gratified to be able to state that during the past year steady progress has been made, and results of immediate practical utility to the scientific instrument industry have been obtained. Besides the specific researches included in the programme of research of the Association, the Director of Research and the research staff are called upon from time to time to undertake minor investigations arising out of urgent problems relating to materials or technical processes of manufacture brought to their attention by members of the Association. Work of this character, as was anticipated, has considerably increased during the year under review. It is desirable that difficult problems of manufacture should be brought before the Director of Research so as not only to enlist the co-operation of the Association in their solution, but also to keep the Association in close touch with the practical needs and difficulties of the members. The status of the Association as the scientific centre of the industry has been increasingly recognised during the past year, not only by the members of the Association, but also by the users of instruments, by Government departments, trade associations, and scientific societies generally. Apart from research there are many questions that arise, affecting the scientific instrument industry, which are largely, if not wholly, scientific questions, in the sense that the main issues involved are essentially scientific.

Industrial Application of Researches

The Council and the Finance and Executive Committee have under consideration the commercial development of the results of the researches undertaken by the Association, as the experience already gained has disclosed the need for some method by which the results of researches can be carried to the point of practical and general application in the industry. It is clear that, if the industry is to derive full benefit from the results of researches undertaken by the Association, it is not sufficient to circulate reports to the members and leave it to them to take all further steps to apply the results to the processes and products of manufacture. It is hoped soon to be able to make arrangements for prosecuting the commercial development of the results of researches without incurring expenditure that would curtail the funds available for carrying on the research work of the Association.

A large number of experiments has been made in the attempt to produce new types of optical glasses, and the Association possesses a number of formulæ of optical glasses, some of which may prove of value as the work of optical instrument manufacturers develops in this country, and the need arises for glasses having special optical constants. Throughout the work attention has been specially directed to the production of a glass which may prove suitable as a substitute for alum in apochromatic lenses and to the obtaining of glasses capable of giving closer approximation to full achromatism by their combinations. The results already obtained have indicated a long series of further experiments with special materials hitherto not known to be employed in optical glass manufacture in order that a complete survey may be made of the possibilities of marked and useful modifications in optical properties. Up to the present some 60 melts on a small scale have been made and the optical constants of the glasses so produced have been determined and recorded. The problem of obtaining a substitute for fluorspar has been attacked, but, although glasses with closely similar ratios in the dispersive constants have been obtained, it has not yet been found possible to secure one of a sufficiently low refractive index.

Abrasives

The subject of abrasives has been dealt with comprehensively and many experiments have been made to prove the value of the special abrasives mentioned in the last report. As a result it may be stated that the work done both in the laboratories of the Association and in the workshops of members has shown that these abrasives possess particular properties which prove that it is desirable they shall be manufactured on a large scale, and definite requests for these abrasives in quantity have been received from several members. It was thought advisable to carry out a long investigation in continuation of what had already been done, with a view to solving the problem of what constitutes a good abrasive, and what are the conditions of practical working under which the properties of such an abrasive can be best and most fully utilised. As a result there appears to be no doubt that the abrasives made in the laboratories of the Association possess properties of value to the optical workers in the direction of fast cutting and the capability of producing a fine and very evenly greyed surface.

Cements for Prisms and Lenses

So far as cements for optical purposes are concerned an elaborate series of experiments on a large number of resins, &c., has resulted in the production of cements, some specimens of which are awaiting report from optical instrument manufacturers. The conditions for preventing crystallisation in Canada Balsam and other cements have been determined, and it may be said generally that, for the greater bulk of optical work, Canada Balsam possesses advantages which are not altogether shared by any other resin or mixtures of resins which have been obtained. At the same time observations have been made on the use of other solvents of Canada Balsam resins, and it is possible that extended trials will lead to a modification of the preparation of Canada Balsam in the direction of using another solvent which may yield valuable results.

During the year the investigation on the durability of optical glasses has been actively pursued. As a general result it may be stated that the difficulty of arriving at simple definite tests for determining the durability of a particular glass has not been overcome, in the sense that it is not possible to put forward any one simple test by which the durability of a glass in its widest sense can be readily determined.

Phosphorescent Zinc Sulphide

Work on the subject of phosphorescent zinc sulphide is continuing in co-operation with the National Physical Laboratory, and certain samples from the Association are undergoing test in the Physical Laboratory.

Investigations have been made on the purification of liquids suitable for bubbles and determinations of their physical constants have been made in so far as they are relevant to the problem. Experiments on level tubes supplied by a manufacturer have been carried out to determine expansion, damping and the conditions to obtain rapidity of response, coupled with minimum time before the bubble comes to rest; further details of value to the manufacturer have also been dealt with.

A report on high melting point solder has been submitted to the department and has been issued to members. Since the publication of the last annual report this solder has been further tried by instrument makers. A sufficient quantity has been made for several pounds to be distributed to each of the members interested, and the reports of its application have been very satisfactory. A low melting point solder has been prepared and samples sent to members. The report on it is awaiting their trials for secular change over a long period.

Wax Mixture as Temporary Adhesive

The attention of the Association having been called to the difficulty of procuring a wax mixture for a temporary adhesive, experiments were carried out in the laboratories of the Association, with the result that a wax was produced which was reported upon by a member as being superior in general properties to one of foreign origin which had been largely in use for some years. Arrangements have been made for the completion of the research by having some pounds of the wax made under manufacturing conditions. Samples will be distributed to members for their consideration as to its utility.

The extra-mural research on the Viscosity of Glass, which was undertaken by Dr. Irvine Masson and Mr. L. F. Gilbert, has been completed up to the point of devising a new method of determining viscosity applicable to the measurement of the viscosity of glass at high temperatures.

A number of experiments have been made into the magnetic susceptibility of materials used in galvanometer coils and evidence has been obtained of the necessity of considering the magnetic properties of each of the elements of the suspended system, as well as those of the wire and covering. A complete survey of the problem has, therefore, to be conducted before it would be right to issue suggestions as to methods which may be adopted for improving coils by treatment of the coil considered as a separate element.

Insulators and Insulating Varnishes

The work on insulators has been continued during the year, but the character of the investigation has been to some extent modified, as certain insulating materials suitable for moulding purposes, made by British manufacturers, have recently been put on the market. Attention was, therefore, concentrated on the production of a material with exceptionally high insulation properties, such as are required only in certain types of scientific instruments. A material has been found which, so far as laboratory tests have shown, is at least equal to Amberoid in its insulating properties. Several flexible insulating enamels have also been prepared, together with a varnish for protecting vulcanite when exposed to sunlight or to an ozonised atmosphere. Samples of the material with exceptionally high insulating properties are being sent to certain members of the Association for further tests, and samples of the vulcanite varnish are also being distributed to interested members.

Among the items in the programme of research of the Association there is the problem of the composition and methods of hardening of steel for magnets and the question of producing cast magnets. Mr. Evershed, of Messrs. Evershed & Vignoles, has devoted much time to the subject, and it was arranged that the investigation should take the form of an extra-mural research by Mr. Evershed. Sir Robert Hadfield has provided special samples of castings and has undertaken to carry on the metallurgical part of the investigation. Sir Robert Hadfield is dealing with the subject of steel for micrometer screws, and he is also doing further work in connexion with rustless steel for pole pieces, springs, &c., in instruments.

Integrating Nephelometer

The Council decided to make a grant towards the cost of the manufacture of one integrating nephelometer, an instrument designed by Professor A. Pollard. It was decided that the Association should bear the cost of the optical portion of the instrument, and that Professor Pollard should undertake the manufacture of the mechanical portions. The former have been made, and it is understood that the instrument is approaching completion.

Subordinate Investigations

In addition to the researches described, the Director of Research and the research staff have been called upon to deal from time to time with various practical difficulties or technical questions that have arisen in the workshops of some of its members. The following are some of the matters on which work has been done or technical advice given: Theoretical questions concerned with the resolving power of microscope lenses under various types of illumination; avoidance of the sticking of mercury on contact points in rocking tubes; cements for (*a*) fixing glass rings or flanges on glass tubes, and (*b*) for fixing glass tubes into brass or other metal sockets and to withstand the action of various liquids. Sample of cement made in the laboratories and supplied in the case of (*b*); explanation of variations in behaviour of steel in corroding atmospheres under fluctuating temperatures; examination of and report on bitumen varnish; advice on methods of protecting metal wires from the action of chlorine gas and a preparation made in the laboratories supplied; examination of and report on a preparation of silica as a polishing medium; critical examination of a report on the performance of a refractometer; examination of scum in a mercury break and report on the conditions favouring its production; plastic insulating medium for use in transformers; preparation of samples of liquids to be tried in level bubbles; and experiments on various mixtures for use as resists in etching glass.

Society of Dyers and Colourists

Manchester Section

The second meeting of the session of the Manchester section of the Society of Dyers and Colourists was held in the lecture hall of the Manchester Literary and Philosophical Society on Friday, November 18. Professor Knecht presided over a large attendance.

Paper by Dr. Everest and Mr. A. J. Hall

A paper on "Tinctorial Properties of some Synthetic Compounds Related to Plant Pigments," prepared by Arthur E. Everest, D.Sc., Ph.D., and A. J. Hall, B.Sc., F.I.C., was read by Dr. Everest and indicated certain facts which were of interest, among others, to amateur gardeners. Probably few enthusiastic flower growers realised that the cornflower owed the tint of its exquisite bloom to the same pigment as the bright red rose, or that the peel of the rosy apple was tinted by pigments of the same class as the skin of the garden radish. It was interesting to notice how beautifully some fabrics, when properly mordanted, could be coloured by means of extracts from ordinary garden flowers, berries or fruits. At one time considerable quantities of certain colours of this class were utilised in actual practice, but owing to their lack of fastness to soap and hot water their importance had passed away, although their fastness to light was excellent. Despite these disadvantages, there were certain cases in which some of these pigments came into a little of their old position during the hard and meagre days of the war period.

The paper also dealt with the groupings of plant pigments, outlining their tinctorial properties, and showing the manner in which research work had been conducted with a view to a fuller insight into the relation between their properties and the constitution of the colouring matters. Numerous products had been isolated recently by various workers, notably Watson and Willstätter.

Dr. Everest also referred to suggestions made in a previous paper, read before the Society by the same authors, and indicated the progress which had been made in connexion with those researches. This work included an attempt to introduce nitrogen into the nucleus by direct nitration, which, however, resulted in the formation of nitrogen-free products in good yield. There was further described a series of reactions whereby the open-chain ketones, which normally condensed to form pyrilium compounds, were first combined with diazonium salts whereby azo-ketonic substances were produced. These products were then converted to the closed pyrilium derivatives whereby azo-compounds of this series were produced. The tinctorial properties of various compounds were indicated and specimens shown.

Discussion

In opening the discussion, Professor Knecht observed that the title of the paper referred to plant pigments, and Dr. Everest had quoted a number of well-known substances such as chlorophyl, carrotin, anthocyans, &c., as plant pigments. The general conception of the term "pigment," from the industrial point of view, was that of an insoluble, highly-coloured substance like some of the organic lakes or inorganic substances such as prussian blue, chrome yellow, and so on. It would be interesting if Dr. Everest could give an opinion as to the form in which these colouring principles were actually present in such flowers as the rose, violet, and other highly-coloured flowers. Was he of opinion that the colouring principle was in the form of a glucoside, or in combination with an organic acid, or was it in combination with tannin or some other material which would actually form a highly-coloured and stable compound? Had the wool samples exhibited been first mordanted with sulphuric acid?

Dr. J. C. Withers thought there was just a bare chance of arriving directly at the amino compounds desired by Dr. Everest without going through the stage of the azo-derivatives.

Mr. J. Campbell Gray enquired if the insoluble pigments could be applied as colouring matters in the form of pigments as generally known, *i.e.*, mineral pigments with the addition of albumen for fixing, and what was the comparison between the colouring power?

Miss Eva Hibbert asked whether it was possible to obtain acetates, or combination with any other acid than tannic acid, and if there was the same kind of damage as was got in the basic colours.

Dr. Thomson understood that if chlorophyl was fixed with a little copper it gave a permanent colour.

Dr. Everest, in replying to the discussion, said it had been almost conclusively established that the sap pigments of the anthocyan series were present in the living plant almost exclusively as glucosides, many of them with two molecules, but some of them with one molecule, or sugar. A well-known exception was that of the black grape, in which there was an appreciable amount of the free non-glucoside present. In the yellow sap colour certain traces had been found of a non-glucoside along with the glucoside. The attachment, or otherwise, of organic acids was a matter which depended almost entirely upon the condition of the sap in which the colour found itself. With regard to the attachment of tannin, he doubted whether in most cases tannin was really definitely chemically combined with these pigments. Most of the products dealt with were soluble in alcohol, but in spite of that fact he could not make complete success with the dyeing. He was afraid the colours would not withstand the treatment they would receive in actual printing and in use of the materials afterwards. The pyrilium derivatives, organic, natural and others would form salts with organic acids.

In proposing a vote of thanks to the authors of the paper, Mr. W. Thomson referred to the use of lichen for dyeing wool by the Scottish country people. The colours produced were quite good.

Society of Glass Technology

A MEETING of the Society of Glass Technology was held in the Fuel Department, the University, Leeds, on Wednesday, November 16, the President (Dr. Morris W. Travers) in the chair.

Following a demonstration by Mr. F. W. Knowles of an "Improved Gas Reversing Valve for Regenerative Furnaces," the meeting resolved itself into a discussion of problems connected with "The Melting of Glass." Members had been invited to send in questions for discussion, but the time available only permitted of the following questions being considered:

1. What effect has the weight and volume of batch filled on and the period of time elapsing between fillings upon the rate and efficiency of melting?
2. Which is the better practice to adopt in filling on batch in a glass tank, to fill on a large quantity at considerable intervals or small quantities more frequently?
3. What is the effect on selenium decolouriser of having saltcake present in the batch?
4. We are often troubled with dark specks in our actinic green glass. We use chromium oxide. What can we do to get this colour and avoid the dark specks?
5. We have sometimes noticed that metal in the tank has appeared to be quite plain, and after a few hours further boil has developed. Can anyone say why this should be caused and what we can do to prevent it?
6. We are interested in the casing of opal on flint glass. We believe that trouble is at times found in the cracking of the glass after manufacture. What are the special points to be observed so as to carry out the process successfully?
7. If a seger cone be made from a glass by grinding and moulding, is there any relation between the squatting point of the cone and the founding and plaining temperatures of the glass?

The questions elicited much discussion in which the President, Professor J. W. Cobb, Professor W. E. S. Turner, Messrs. F. W. Adams, J. Adamson, M. Asquith, F. F. S. Bryson, W. Butler, F. G. Clark, E. A. Coad-Pryor, J. Connolly, J. H. Davidson, W. B. Sanderon, Guy Simpson, V. H. Stott, and Th. Teisen took part.

Mr. R. L. Frink had also sent replies to several questions, and these were communicated to the meeting by Professor Turner.

The President announced that the next meeting would be held in London on December 14, and that by the courtesy of the directors a visit had been arranged for the forenoon of that day to the works of the United Glass Bottle Manufacturers, Ltd., at Charlton.

Chemical Laboratory Fire

AN OUTBREAK OF FIRE in the chemical laboratory of Duncan, Flockhart, & Co., North Bridge, Edinburgh, on November 16, resulted in the destruction of the contents of the laboratory.

American Notes

A NEW chemistry building to be erected at the University of Iowa is expected to cost $1,000,000.

Speaking at Baltimore recently, Mr. Miller, of the Davison Chemical Co., said there had of late been a marked increase in the demand for sulphuric acid.

One hundred and ninety-four colleges and universities in the United States have already agreed to purchase the chemicals in units of the metric system.

During September thirty-five companies, each with a nominal capital of $50,000 or over, were registered to manufacture chemicals, dyes and allied products.

The Emergency Tariff Bill, which provides for the protection of the synthetic organic chemical industry, and which was due to expire on November 27, has been extended until February 1 next.

Mr. J. R. McIntosh, of the New York office of R. W. Greeff & Co., Ltd., is a member of the November Meeting Committee of the Salesmen's Association of the American Chemical Industry.

It is announced that Mr. E. R. Weidlein, has been appointed Director of the Mellon Institute of Industrial Research. Mr. Weidlein has been acting-director since the recent resignation of Dr. R. F. Bacon.

The plant which is being built at Midland, Michigan, by the Dew Chemical Co., for the manufacture of acetylsalicylic acid, is nearing completion. It is understood that operations will be commenced before the end of the year.

As a result of researches on the physiological effects of poison gases some of the chemists of the Chemical Warfare Service are of the opinion that certain gases may be of use in the treatment of diseases of the nose, throat and lungs.

Mr. P. Giraudet, of Louisiana, has applied for a patent for a process for the manufacture of synthetic camphor from turpentine. The inventor claims that by this process camphor can be produced in ton lots, and that 100 lb. of turpentine will produce 50 lb. of camphor.

The Committee on Guaranteed Reagents and Standard Apparatus is co-operating with the Standardisation Committee of the Association of Scientific Apparatus Manufacturers in an attempt to extend the benefits of standardisation to all members of the American Chemical Society.

The soap section of the American Specialty Manufacturers' Association, which represents the majority of the U.S. soap manufacturers, has appointed a committee to discuss with the Bureau of Standards the revision of soap specifications contained in the Bureau of Standards' circular 62.0.1916.

Speaking at Rochester on "The Chemical Welfare of America," Dr. E. Hendrick said that between 90 and 95 per cent. of all the dyes they needed could now be manufactured without difficulty in the U.S.A., and these dyes could be made at a cost which would not unnecessarily add to the cost of the dyed materials.

During September dyes and dyestuffs were imported of the total weight of 296,214 lb., valued at $413,436. Imports from the United Kingdom totalled 55,132 lb., valued at $61,707. This total included 3,737 lb. of alizarine and alizarine dyes; 4,072 lb. of natural indigo; and 47,323 lb. of other colours, except synthetic indigo.

An organisation known as the Synthetic Organic Chemical Manufacturers' Association has been formed in Washington, with Dr. C. H. Herty as President. The objects of the association are, *inter alia*, to encourage the manufacture in the U.S.A. of all kinds of organic chemicals, to afford means for the dissemination of scientific knowledge, and generally "to take such collective action as may be proper for the establishment and perpetuation of the organic chemical independence of the U.S.A."

Catalogues Received

WE have received from A. Gallenkamp & Co., Ltd., circular No. 231, which consists of a list of the firm's electrically heated laboratory apparatus. They have devoted their attention for some time past to electric furnaces, and they have now extended the use of electricity to a number of laboratory appliances.

Meldrums, Ltd., of Timperley, near Manchester, send us an addition to their catalogue describing and illustrating the "Meldrum" motor trailer for use in conjunction with a motor car for the delivery of goods, &c.

Chemical Industry Club Annual Dinner

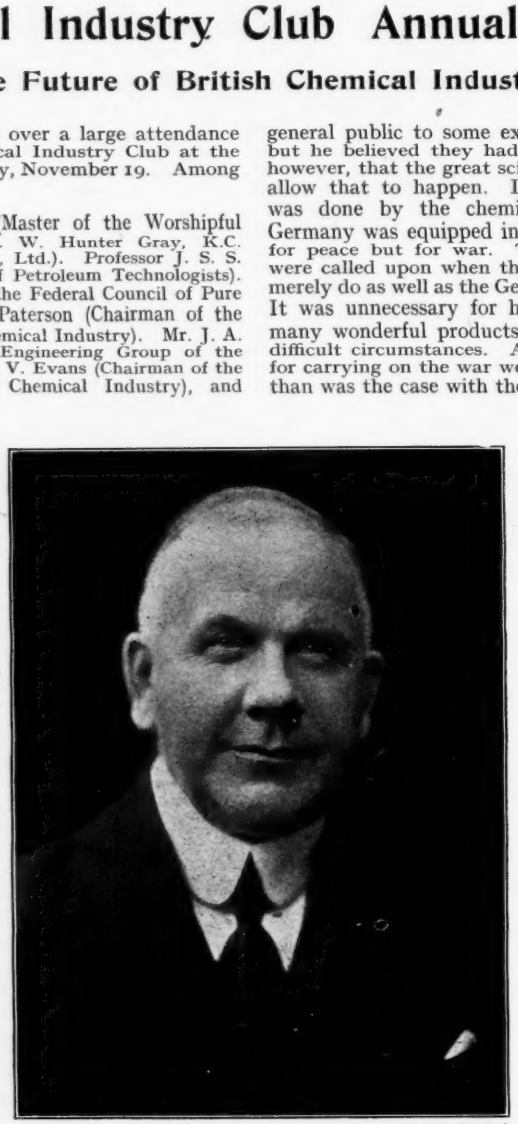
The Future of British Chemical Industry

MR. A. CHASTON CHAPMAN presided over a large attendance at the annual dinner of the Chemical Industry Club at the Connaught Rooms, London, on Friday, November 19. Among those present were the following:

GUESTS.—Mr. Harold J. Johnson (Master of the Worshipful Company of Tallow Chandlers). Mr. W. Hunter Gray, K.C. Mr. Max. Muspratt (United Alkali Co., Ltd.). Professor J. S. S. Brame (President of the Institution of Petroleum Technologists). Dr. Stephen Miall (Hon. Secretary of the Federal Council of Pure and Applied Chemistry). Dr. J. H. Paterson (Chairman of the Newcastle Section of the Society of Chemical Industry). Mr. J. A. Reavell (Chairman of the Chemical Engineering Group of the Society of Chemical Industry). Mr. E. V. Evans (Chairman of the London Section of the Society of Chemical Industry), and Mr. W. J. U. Woolcock, M.P. (Secretary of the Association of British Chemical Manufacturers).

CLUB OFFICIALS.—Mr. A. G. Craig (Chairman of Executive Committee). Dr. W. R. E. Hodgkinson, C.B.E. (Immediate Past Chairman of Executive Committee). Mr. H. Edwin Coley (Hon. Secretary). Mr. W. Cullen (Hon. Assistant Secretary). Capt. C. J. Goodwin (Hon. Treasurer), and the following members of committee: Messrs. Ashley Carter, A. J. Chapman, Dr. F. B. Dehn, W. Graham, F. E. Hamer, Harley F. Knight, Dr. W. R. Ormandy, R. B. Pilcher, Dr. A. Rule, Dr. E. H. Tripp, E. C. Wilbraham, H. Melville Smith.

GENERAL ATTENDANCE.—Messrs. G. J. Alderton, A. G. Allen, J. W. Allen, W. T. Allen, Major L. J. Barley, H. Beadle, J. D. Bishop, E. R. Bolton, H. W. Booth, G. D. Borland, W. D. Borland, E. T. Brewis, H. J. Bush, E. A. Buckle, — Cartellière, R. R. Chambers, P. C. Chaumerton, F. J. E. China, F. W. Chinery, T. W. Clark, T. Clayton, A. Connell, J. E. Crane, E. C. Craven, A. S. Dains, H. H. Dains, J. B. Dampney, B. F. Davis, H. C. Davis, M. D. Davis, A. Davidson, J. Dean, M. B. Dickie, Dr. H. Dreyfus, R. J. Eiche, F. C. Elphick, F. H. English, C. H. Field, A. C. Flint, P. M. Fraser, H. R. Fuerst, J. Fuerst, H. W. Graesser-Thomas, C. S. Garland, H. J. Garnett, W. J. Gee, A. C. Gregory, B. S. Green, F. A. Greene, R. B. Grey, T. W. Hall, Dr. Lance Hall, W. H. Halls, G. A. Hamilton, P. H. Hargreaves, Capt. R. P. C. Harvey, E. W. Harvey, R. L. Hawkins, W. L. Hill, Professor J. W. Hinchley, Capt. C. R. Hodgkinson, A. H. Hughes, G. C. Irwin, Capt. B. R. S. Jones, J. Kewley, Dr. Leach, W. S. Lloyd-Willey, W. Maclachlan, L. Mangold, W. McCornish, T. M. McKenzie, G. W. Marlow, H. Martin, S. W. Marshall, C. A. Mercer, E. R. Micklem, T. Miller-Jones, A. V. Milnes, P. H. Mitchell, W. J. Mitchell, Robert Mond, P. Mond, F. G. Murray, H. E. Mussett, G. Neville, C. J. Newton, L. O. Newton, A. G. Nutter, M. O. Ockenden, G. O. Pearce, W. Penny, N. Prentice, R. A. Punter, W. S. F. Rackham, D. G. Reid, W. Rintoul, J. Rogers, J. F. Ronca, H. Russell, J. Sanderson, E. H. Scholl, C. W. Sherrock, S. Soloman, P. E. Spielman, F. C. Sutton, H. Talbot, G. C. Townson, S. W. Thorpe, P. Tingey, R. V. Wallis, F. B. Warner, — Weil, S. A. H. Whetmore, A. F. Young, J. Young.



Barony & Co., Ltd.

MR. A. G. CRAIG,
The new Chairman of the Club.

The first two toasts were those of "The King" and "The Prince of Wales."

Profession and Industry of Chemistry

MR. J. HUNTER GRAY, K.C., who proposed "The Profession and Industry of British Chemistry," said that scientific men were not counted as great factors in the British nation before 1914, but they could say without conceit that it was the work of the scientific men which enabled us to win the war. The general public to some extent during the war realised that, but he believed they had now forgotten it. It was wrong, however, that the great scientific bodies of the country should allow that to happen. During the war the greatest work was done by the chemists and the engineers. In 1914 Germany was equipped in every scientific branch not merely for peace but for war. The scientific men of this country were called upon when the war broke out, and they did not merely do as well as the Germans; they exceeded the Germans. It was unnecessary for him to recall all they did and the many wonderful products which were produced under most difficult circumstances. All the necessary chemical products for carrying on the war were produced better in every respect than was the case with the Germans, who had been preparing through twenty-five to thirty years to do these things and to prevent this country from having them at the time of its greatest need.

Mr. Gray said he was always appalled when he thought of these things and the attitude of this country towards scientific research and the scientific man. He was not sure that he should confine himself to the public in speaking of this attitude. He should also include the Government Departments, because if there was scientific research work to be done costing £1,000 we usually got £10. Yet the sum of £100,000,000 was to have been found for the building of four great warships; he understood that these were not now to be built, but scientific research in this country would never get such a sum or any part of it unless scientific men were recognised as an important section of the British public. That meant unity among the scientific men, which was essential for the prosperity of this country in the future. As a humble observer, he did not believe there was not going to be any next war at all. His own feeling was that there might come a day, and very soon, when either a British or a German or some other scientific man would make a discovery by means of which a whole nation could be destroyed, and that would be accomplished by scientific method and by scientific determination. It would be an appalling thing if this country should lose that position, not because we wanted to destroy any other nation, but because we wanted to be able to say we could destroy other nations unless they played the game. That was what we had to think of from the point of view of war at the present time.

The next question he wished to touch on was that of prosperity and peace. There was not a nation in the world which depended so much upon its industries for success as Great Britain and her colonies. It was unthinkable that any other country in the world should be better prepared in scientific work than this country, and we had the capacity to be first. We had not lost it. The war had shown that the powers of the scientific men of this country were much more spontaneous and much more magnificent than those of that perfectly-trained machine, the German. But how were we going to get the full benefit of the knowledge of our scientific men? Were we going to get it by meetings of our scientific societies and by discussing problems? He did not think so. We must compel the public to appreciate that the prosperity of science, applied and theoretical, must

be our first object, because without it our industries must go down. Unless the public and the Government encouraged invention, our industries would go down. Scientific men must combine to teach the public that the public good was the advancement of science in its theoretical and applied aspects. If they did that, this country was going to prosper. Germany at the present moment had an exchange of 1,000 marks to the pound sterling. How was it possible, unless the scientific men of this country were encouraged to make invention, revolutionary invention, that we could stand the strain of that? It only needed a few years, and if we did not move Germany would have the markets of the world. At present the general public and the Government in this country were perfectly uninformed, and to a large extent perfectly callous, about the prosperity of science. Improvements, of course, were being made, but the Department of Scientific and Industrial Research had seemed to do very little. No doubt it would do good, but it was only scratching at the surface of the question. Therefore he asked all members of the chemical profession to bear in mind that unless there was unity among the scientific men of this country, so as to have science recognised and encouraged, we were going to be in a very difficult position, not in the next generation, but in the next few years.

Mr. Max Muspratt

MR. MAX MUSPRATT, who responded to the toast, said there was nothing more frequently read or heard during the early years of the war than the question, "What is wrong with the British Chemical Industry?" but after a considerable experience of the industry, both pre-war and under war conditions, he believed the best way to describe the position was to say that the British chemical industry was suffering from an excess of modesty. They had not learned to advertise; they had not learned to make themselves known throughout the country and the world at large. They were satisfied with the really true, honest work they were doing, and magnificent work it was, and they did not call in the general public either in the pages of the "Daily Mail" or "John Bull" to tell the country that it was really all right.

As a sidelight on the excess of modesty of the chemical industry, he recalled that at one time he was a member of the Council of the Society of Chemical Industry and later a Vice-President. There was then no such thing as a club for the chemical industry. Their meetings were held in a comparatively small office in Bridge Street, Westminster, and the business usually took from about five to seven o'clock, and then the council adjourned to dine together at a modest restaurant in Soho, where they had excellent food and excellent wine and excellent times altogether. Now things were very different; if any of those who attended those meetings about fifteen years ago had ventured to suggest that there would have been such magnificent dinners as the one that evening under the auspices of a Chemical Industry Club he would have been removed from the council of the Society as mentally *non compos*. The establishment of the Chemical Industry Club and the holding of annual dinners in the Connaught Rooms was an outward and visible sign that the industry was shedding some of that excess of modesty which had done the industry and the chemical profession so very much harm in the past and risked the life of the nation in the critical years through which we had passed.

What was the position at the outbreak of war? With the exception, perhaps, of three members of Parliament and himself outside, there was absolute and complete ignorance of the chemical industry when the war broke out. There was also ignorance on the part of the Government Departments, with the exception of his friend Professor Hodgkinson, and he was always turned down whenever he made a suggestion which combined chemistry with common sense. With this exception, there was absolute and complete ignorance in the Government Departments and the House of Commons of what the chemical industry and profession of Great Britain was or could do, and in the usual methods of Government Departments, whenever they approached an important subject with complete ignorance they looked up a register and picked out anything that looked like a chemist, whether it was a pharmaceutical chemist, a consulting chemist, a chemical agent for a German manufacturer, a marine store dealer, or a professor of chemistry at a university. Probably they took a pencil and closed their eyes and dotted the list, and they sent for the men on whose names the pencil fell, and these were the persons who became the important consultants in vital questions affecting the conduct of a great war, as advisers upon the chemical industry. He need hardly point out that there were weak points in that method of dealing with a national crisis.

He had specially omitted from the list of people he had referred to as being called upon the chemical manufacturers. They were on a black-list, and that reflected great credit upon the Government officials. There must have been some person somewhere with a grain of intelligence. There was a black-list of chemical manufacturers with the names of the leading members in the various works whose movements must on no account be recounted in the Press in any form whatever. That was absolutely right; it was one of the few marks of intelligence in the early years of the war on the part of the Government in dealing with the chemical industry, because it was perfectly well known in those earlier years that anything that was published was sent to Germany. Some genius had realised that, and they said that what the chemical manufacturers were doing in this country must not be known in Germany if it could possibly be helped. Thus the chemical manufacturers were upon a black-list, but they were never consulted or called in to advise at all. As a chemical manufacturer he was not making any complaint, because it made it very much easier for him to deal with the problems which he knew would arise in the chemical industry than if he had been fussed by a Government Department from the start, but it led to this trouble: At a time when every person with chemical knowledge of any kind whatever should have been recruited by the Government Departments, and given their duties after full discussion of what the problems were, there were various sources of supply of chemical knowledge plentifully diluted with chemical ignorance, and every member working one against the other instead of all working together. He ventured to say that victory was delayed two years; we should have won the war two years earlier if those around the tables that evening had been called in to conference by some competent person to deal with the problems instead of dealing with them in watertight compartments. (Applause.) Many of them in complete ignorance, working badly in every way; and even the best of them only partially informed as to the great possibilities of the chemical profession and industry of this country. He asked no favours of the Government. He was not accustomed to asking favours, he was accustomed to extracting rights. He ventured to say that if the chemical industry and profession met each other as they did that evening, if there was the frankest and freest exchange of opinion between the various societies, such as the Institute of Chemistry, the Society of Chemical Industry, the Association of British Chemical Manufacturers, and so on, centring in the Chemical Industry Club, then they would every one of them know what the chemical industry could do in England, and if the time of crisis ever arose again they would not ask the Government Departments; they would dictate to them what should be done. (Applause.)

As far as peace problems were concerned, he did not think he need say very much because they all were dealing with these problems in their own way and, he ventured to say, in a way which permitted of no conflict of interests between the large body of men and capital concerned. Through those various societies they were learning to know and understand one another. They were each looking after their own job, and they were not allowing, nor was there the desire for, other people to butt in. They knew the value of every branch of the profession and he believed that even the most professional of the men was beginning to learn the value of the manufacturers. (A voice: "What about the merchants?") Mr. Muspratt retorted that he was not leading a debate. All of them, as members of the chemical industry and the profession, had felt the severe burden of the times—the hardships and readjustments necessitated by the times—but they were one of the greatest barometers of industry of this country and the world at large, and as one who had to take the readings of that barometer day by day and week by week, he was certain that Great Britain and the world at large had passed the worst. We had passed the trough of the wave and prosperity was returning slowly but surely. The permanence of that prosperity and the permanence of the rehabilitation of the world depended in no small degree upon such men as those who were present at that dinner, but he had every confidence in them as good brothers, as good patriotic citizens, to face the difficulties of the moment with courage and determination, and he was confident that if they pulled together, as they learned to pull together during the war, then there was nothing but the very highest prosperity for the profession

and industry of chemistry in Great Britain and the British Empire. (Applause.)

"The Club" and "The Visitors"

MR. HAROLD J. JOHNSON (Master of the Worshipful Company of Tallow Chandlers) proposed "The Chemical Industry Club," remarking that the large number present was evidence of the appreciation of the Club, which had many points about it which were not to be found in other clubs in London.

DR. HODGKINSON reminded those present that the Worshipful Company of Tallow Chandlers offered the Club the hospitality of its hall on the occasion of its first annual dinner.

MR. A. G. CRAIG (Chairman of the Executive Committee), responding to the toast, said there was no doubt as to the value of the Club, for it was in a flourishing state. The membership was now 700, which was very good from some standards. At the same time, it ought to be considerably more, for there was a very large field to draw upon yet. The Institute of Chemistry had a membership of 1,570 Fellows and 1,930 associates; the Chemical Society had 3,836 Fellows; and the Society of Public Analysts had approximately 500 members. The London Section of the Society of Chemical Industry had 1,200 members, and the Institute of Petroleum Technologists 500 members. There was also the British Chemical Trade Association, with a large membership, whose chairman, he was pleased to say, was present. From the figures which had been given him, there appeared to be a total of 9,536 members of the different societies, yet the membership of the Club only represented a percentage of that number, about 1½ per cent. That was not what it should be, by a long way, and he hoped that none of those in the room who were eligible for membership should go away without signing an application form. The subscription was only three guineas a year, and it had been kept at that low figure in order that it might bring membership of the Club within the reach of everyone. This worked out at 2.074 pence per day for town members, and for country members at 1.38 pence per day. (Laughter.)

The toast of "The Visitors" was proposed by Mr. F. E. Hamer (Member of the Executive Committee), who mentioned that letters of regret at inability to be present had been received from Sir Daniel Hall, Sir John Brunner, Sir William Pearce, M.P., Sir Robert Robertson, Sir James Walker, Professor Henry Louis, Mr. Roscoe Brunner, Dr. H. W. Brownsdon (Birmingham), Dr. H. E. Watt (Edinburgh), Dr. E. C. Clayton (Liverpool), Mr. J. H. Young (Glasgow), Mr. J. H. Durnford (Nottingham), Mr. S. H. Davies (York), Mr. Alfred Smetham (Liverpool), Mr. L. G. Radcliffe (Manchester), and Mr. H. M. Ridge. He associated the toast with the names of Dr. Stephen Miall (Hon. Secretary of the Federal Council of Pure and Applied Chemistry) and Dr. J. H. Paterson (Chairman of the Newcastle Section of the Society of Chemical Industry).

DR. STEPHEN MIALL, in the course of his reply, said that he was a member of the Club, but he appreciated the honour of being invited as a guest as the Hon. Secretary of the Federal Council. That was because Sir William Pope and Professor Armstrong, either of whom should have represented the Council, were both abroad. It was only through such institutions as the Club and the Federal Council that chemists as a body could make their influence felt in the way it should be, and the Federal Council was only too pleased to have the support of the Chemical Industry Club in that work.

THE CHAIRMAN, in replying to the toast of his health, proposed by Dr. W. R. Ormandy, said there was no doubt that the Club had filled a very long and badly felt want. Before it was established there was no place where chemists could foregather and discuss matters of common interest, and there was no place where chemists from the provinces could conveniently meet their metropolitan friends and colleagues. He hoped that in time the Club would be linked up with the scheme for a central home for British chemistry. When they considered the enormous importance of chemistry to the community and its relation to national security, it was a disgrace that there should not be in this country a home worthy of chemistry. That scheme, however, was, for reasons which they knew, in abeyance at the present time, but he was confident that it would materialise eventually, and then the Chemical Industry Club would become a very important adjunct in catering for the social side of those engaged in chemistry.

The British Empire Exhibition

THE Executive Council of the Association of British Chambers of Commerce at their last meeting had under consideration a resolution unanimously adopted at the quarterly meeting held in Sheffield on October 21 last. On that occasion the Association recorded its support to the British Empire Exhibition 1923, and urged its members to co-operate with the local authorities in raising the necessary Guarantee Fund, and to do everything possible to make the exhibition a success, the Association believing that the exhibition will be of great benefit to the Empire in showing its products and resources to British people and to the world. The Council emphasise one point which, they state, has hitherto been imperfectly appreciated. To ensure the complete success of the exhibition, not merely from the exhibitor's point of view, but from the influence which it may exert on public opinion in this country, it is thought very desirable to spread the interest as widely as possible; no one should be deterred from contributing to the Guarantee Fund because they feel that they can only guarantee a small amount. The Executive Council point out that it is not anticipated that any call will be made upon guarantors, but that in any case no call could be made until the affairs of the exhibition are wound up, and then only in the very unlikely event of a deficit resulting. Any such loss spread over a Guarantee Fund of at least one million sterling can only involve a comparatively small percentage of each guarantee being called up; the Council also point out that every guarantor receives a valuable collateral security in the fact that the whole assets of the British Empire Exhibition will be handed over to a company already registered for the purpose of carrying on Wembley Park as a permanent trade and athletic centre, and that the first charge on the profits of this company will be the entire reimbursement of any sums paid by the guarantors in the unlikely event of their being called upon. The name of the company is the British Empire Exhibition Assets Co., Ltd.

A Tribute to Trade Journals

DR. HUGH P. BAKER, executive secretary of the American Paper and Pulp Association, at a recent meeting of the trade secretaries of New York, was warmly supported in a plea he made that trade associations should support their independent and unofficial trade journals:

"The official publication of a trade association, its bulletin or magazine, or whatever form its published material may take, should never be of a nature to place the association publication in competition with the trade journal," said Dr. Baker. "The trade journal has a vital field in industry, just as well-defined and as helpful to the industry as the trade association. To co-operate with the trade journal and not to publish a journal in opposition should be the aim of the trade association secretary. Particularly, I believe, is this true of the question of advertising. I doubt if the solicitation of advertising by an association publication is right or proper. In most cases it is too close to the use of the big stick against those dealing in supplies for the industry, and might easily be unfair competition with the trade journal which means so much to the business man. In the American Paper and Pulp Association care is exercised to maintain most harmonious relations with the trade journals. They are provided with all of the material published in the Association bulletin to its members, either simultaneously or in advance of its publication by the association publication. The bulletin of the association acts as an auxiliary to the trade journal to take merely official announcements of the industry to its members."

Affairs of Benzoates, Ltd.

THE adjourned first meeting of the creditors of Benzoates, Ltd., 113, High Street, Watford, Herts, chemical merchants, was held on November 17, at 29, Russell Square, London, W.C. 1. The Official Receiver dealt with the proofs of debt lodged amounting to £8,369 13s. 3d., and referred to one claim for £3,038 7s. 11d. He stated that this was admitted at the previous meeting for voting purposes, but since then he had received certain statements, and it now seemed to him that a portion of the claim could not now be admitted. After some discussion it was decided that no application should be made to the court for the appointment of a liquidator other than the Official Receiver.

The Claude Synthetic Ammonia Process

Technical Description by Mr. J. H. West

THE most detailed description yet given in this country of M. Georges Claude's process and plant for the synthesis of ammonia was contained in a paper read on Tuesday evening by Mr. J. H. West, A.C.G.I., M.I.C.E., before a joint meeting of the Chemical Engineering Group and the Institution of Mechanical Engineers in the lecture theatre of the Institution of Electrical Engineers. Mr. J. A. Reavell, president of the Group, presided over a large attendance.

MR. WEST, in the course of his paper, dealt first with the more familiar features of the Claude process, such as the higher pressures, as compared with those of the Haber process. A diagram prepared by Claude from experimental data showed that for a given temperature the proportion of nitrogen and hydrogen remaining combined under conditions of equilibrium increased rapidly with rise of pressure, and that the lower the temperature the higher the proportion of combination. The speed of reaction, however, had to be considered, and this resulted in a compromise. Claude found it best to work at about 600°C., and he used a pressure of 900 atmospheres, or nearly 6 tons per sq. in., as against the 200 atmospheres used by Haber. The hydrogen and nitrogen, mixed in the proper proportions, were first compressed to 100 atmospheres in an ordinary three or four-stage compressor, passed through separating bottles, where any condensed moisture and oil from the compressor were drained off, and thence went to the "super-compressor." This was an exceedingly simple two-stage machine, capable of dealing with enough gas to make 5 tons of liquid ammonia per twenty-four hours—a duty of 426 cub. ft. per minute. One of these machines had been running in France for some nine months past, and has given no trouble; in fact, there were few compressors for 100 atmospheres which ran so sweetly and silently, and with such freedom from vibration. The first result or consequence of working at super-pressures was that the pipework became very small. The pipes carrying the mixed nitrogen and hydrogen for a plant making 5 tons of ammonia per day were only 8 mm. bore, and the difficulty of making gas-tight joints and valves was thereby enormously reduced.

Catalyst Vessels

The fact that the proportions of combination was much higher at 900 atmospheres than at 200, viz., about 42 per cent. as against 13 per cent., had some very important consequences. The formation of ammonia was an exothermic reaction producing 717.6 calories per kg. of ammonia formed. When the proportion of combination was low, as was the case at 200 atmospheres, the heat produced by the reaction was not sufficient to maintain the catalyst vessel and the incoming gases at the proper temperature unless the losses from radiation were reduced to a minimum by reducing the radiating surfaces as much as possible. This fact compelled the Germans to devise enormous catalyst vessels, not simply for the sake of having large units, but in order to minimise loss of heat by radiation, and the preliminary heating up is done by injecting air and burning part of the hydrogen. The great cost of manufacture of these huge vessels, the difficulty of handling them, and the time lost in making the joints, could easily be realised. At 900 atmospheres the conditions were quite different. The heat produced by the reaction was sufficient to make it auto-thermic, so that no external heat need be supplied once the reaction had started. The reaction started and stopped quite suddenly.

Under Claude's conditions quite small catalyst vessels could be used, which could be heated initially by external electric circuits, and after that the problem was to get rid of the excess heat. The usual way of expressing the relative efficiency of catalytic reactions was in terms of grammes of product per produced hour in each litre of volume occupied by the catalyst material. In the case of the Haber process this figure was about 350-400 grammes, and in Claude's process it ranges from 5,600 to 6,700 grammes.

The respective weights of the Haber catalyst vessel and the Claude catalyst tubes for a production of 20 tons of ammonia per day were approximately 74½ tons and 11¼ tons. Furthermore, in the Haber process, owing to the necessity for circulating the gas round and round over the catalyst, it was essential to have very large and complicated heat interchangers, in order that after each passage over the catalyst the gas might be cooled sufficiently to remove the ammonia and then be heated again to reaction temperature. The time required after a stoppage to get the whole Haber system heated was three days, whereas, starting all cold, the Claude plant would begin to produce ammonia in four to five hours. In the Claude plant there are four catalyst tubes. On actual tests the observed proportion of combination had been found to be from 81 to 83 per cent.

As to the actual construction of catalyst vessels to withstand a temperature of 600°C., a high pressure, and possible attack by the hydrogen, the Haber people made an inner vessel of very pure iron and surrounded it with a layer of nitrogen under slightly higher pressure than that used inside, thus hoping to protect the outer vessel from the action of the gases. This was not a success, and they now used an outer vessel of high-tensile steel, probably tungsten steel, and protected it with a lining of pure iron. Since this lining was permeable to hydrogen, the outer vessel was perforated all over with small holes, so that any hydrogen passing through the lining could escape and not set up a pressure between the lining and outer vessel. With the small Claude tubes it was possible to do away with all lining, and use a special nickel-chromium alloy. Some of Claude's tubes had been made by a French firm of steel makers, and some by Vickers, of Sheffield, who had independently worked out alloys of this type. Vickers' metal was known as "Vicronic," and it had very remarkable heat-resisting properties.

Catalyst Material

As to the catalyst material Mr. West said it was not difficult to find a large number of substances which would give a good activity for a short time if pure gases were used, but it was quite another matter to find a catalyst which would have a long active life under works conditions and with gases only technically pure. In this Claude has succeeded admirably; he used a material which was made from very cheap materials by a simple process. The basis of his catalyst material was peroxised iron prepared by burning iron in oxygen, with the addition of other equally cheap materials which were added in order to increase its activity and its immunity from poisons. The oxide of iron was, of course, reduced by hydrogen in the catalyst tube. Other catalysts might perhaps be more effective scientifically than Claude's, but their use necessitated the most elaborate precautions in removing the last traces of impurity from the gases. One of the most deadly catalyst poisons liable to be present in hydrogen obtained from coke-oven gas or water-gas was carbon monoxide. Claude often used hydrogen containing 2 or 3 per cent. of carbon monoxide, and this was made possible by an extremely simple device. A tube, similar to the catalyst tubes, was traversed by the gases on their way from the super-compressor to the catalyst tubes proper. This "protector" tube was filled with spent catalyst material which had become insufficiently active for further use in the catalyst tubes, and was heated to about 400°C. Any carbon monoxide present in the gases was converted into methane, $CO + 3H_2 \rightarrow CH_4 + H_2O$. Any oxygen present was at the same time burned to water. The robust nature and fool-proof quality of Claude's material was one of the things which most impressed visitors to his plant.

Removal of Ammonia from Catalyst Tubes

The question next arose as to how the ammonia formed in the catalyst tubes was removed from the system. Here again the use of superpressures resulted in striking advantages. On cooling the gases containing ammonia to ordinary temperature, a certain proportion of the ammonia would liquefy out and might be separated by gravity from the gas, this proportion depending upon the ratio of the vapour pressure of ammonia to the total pressure of the gases. Under the Haber conditions with 200 atmospheres the Germans found it necessary to inject water into the system and thereby recover the ammonia as an aqueous solution. This all con-

sumed a good deal of power and involved no little complication of plant, while if the ammonia was required in the anhydrous state the liquor had to be distilled. At 900 atmospheres, however, simple cooling by a coil immersed in water sufficed to liquefy the whole of the ammonia save 2 or 3 per cent., and this small quantity was easily removed from the residual gases either by further cooling produced by the vaporisation of part of the ammonia, or by absorption in sulphuric acid. The uncombined or residual gases from the last catalyst tube, after removal of this ammonia, were returned to the system.

After describing the general arrangement of the plant, Mr. West said that that completed the description of the Claude plant and process for making synthetic ammonia, and demonstrated it to be a remarkably simple, straightforward, and fool-proof way of attaining the desired result.

Cheap Hydrogen Essential

The raw materials (hydrogen and nitrogen), and the power requirements of the process were next considered. Nitrogen could be made in standard liquid air machines at a cost of a few pence per thousand cubic feet, and since there was only one volume of nitrogen to three volumes of hydrogen, the cost of it was not an important item, anyway. Hydrogen, however, was a big item in the cost, and cheap hydrogen was essential to the commercial success of synthetic ammonia.

In this country, and at the present time, probably the most economical source of hydrogen was existing coke ovens. He said "existing" advisedly, because it would be another story if coke ovens had to be built at to-day's prices and a market found for the resulting coke. The process adopted for separating the hydrogen from the coke-oven gas was a simple one of liquefaction in a modified form of liquid air plant. The principle was one of fractional liquefaction, and not of fractional distillation as in the liquid air process. The coke-oven gas, after stripping in an ordinary by-product plant, was compressed to 25 atmospheres and passed through a tower containing water which dissolved most of the carbon dioxide, the last traces being removed by lime-water injected at the top of the tower. Were the carbon dioxide not removed, it would solidify and choke up the liquefaction apparatus. The compressed gas was then progressively cooled, the ethylene and similar hydrocarbons first liquefying, then the methane, after that the carbon monoxide, and finally the nitrogen, leaving only the hydrogen in the gaseous state. The nitrogen was liquefied at the top of the apparatus, and running down washed away the last traces of carbon monoxide which dissolved in it. The issuing hydrogen was allowed to expand while doing external work in an engine, and it was thereby cooled to about —210° to —215°C., and subsequently absorbed heat from the incoming coke-oven gas in a heat interchanger. The question of lubricating the cylinders of the expansion engine on this plant provided a nice problem. Petroleum ether made a good lubricating oil for low temperature work, freezing only at —90°C., but this job was beyond it. Claude found a simple solution of the difficulty by mixing with the hydrogen a little nitrogen (the presence of which was of course quite harmless), whereby some of the nitrogen liquefied in the cylinders and formed an excellent lubricant. The manufacturing cost of hydrogen separated from coke-oven gas in this way was about 1s. 6d. per 1,000 cub. ft. The remaining gases could be burnt in gas engines to produce power, and if the air admitted was reduced to a minimum the exhaust gases after removal of water and carbon dioxide were nearly pure nitrogen, thus providing another source for this material.

In countries where cheap water power was available, electrolytic hydrogen became very attractive. The following table shows the comparative power requirements and cost of power per ton of ammonia as between hydrogen obtained from coke-oven gas with steam power at ½d. per unit, and electrolytic hydrogen with hydro-electric power at 1·25d. per unit:

	Hydrogen from coke-oven gas. Steam power at ½d. per k.w.h.		Electrolytic hydrogen. Hydro-electric power at 1·25d. per k.w.h.	
	k.w.h.	%	k.w.h.	%
Nitrogen	279	8.53	279	1.79
Hydrogen	1,287	39.35	13,590	87.27
Compression	1,530	46.78	1,530	9.82
Miscellaneous ..	175	5.34	175	1.12
Total	3,271	100.00	15,574	100.00
	Cost £6 16s. 3d.		Cost £2 11s. 11d.	

Industrial Uses of Synthetic Ammonia

Dealing with the industrial future of the Claude process, Mr. West said that the two main outlets for synthetic ammonia were, of course, nitrogenous fertilisers and nitric acid for making explosives. Taking the latter first, the national advantages of having large synthetic ammonia plants available in case of war were obvious, and it was ancient history to-day that without the Haber plants the Germans could not have carried on the war beyond a year, while we and our Allies were entirely dependent upon our command of the sea for supplies of Chile nitrate from which to make our explosives. The late Lord Moulton spoke most feelingly on this subject in the last public speech he made, one before a meeting of the Association of British Chemical Manufacturers on February 16 last, in which he alluded to the terror he felt during the four years of the war owing to the risk of German submarines concentrating on the nitrate ships. For peace time uses synthetic ammonia provided the cheapest source of nitric acid, and solved the transport difficulty, for ammonia was comparatively easy to transport; it contained over 82 per cent. nitrogen against about 15½ per cent. in commercial Chile nitrate, and it could readily be oxidised to nitric acid at the place where the acid was to be used.

As regards fertilisers, the ammonia had to be "fixed" in some way, either with sulphuric acid to form sulphate, or by a modified form of ammonia-soda process to give chloride, an important by-product of this process being bicarbonate of soda. There were, of course, other possibilities for the future such as synthetic urea, and for special markets which must have nitrate of soda this product could be made synthetically at a cost well below that of the natural product.

Discussion

THE CHAIRMAN said he wished to draw attention to the fact that this was the second meeting which the Chemical Engineering Group of the Society of Chemical Industry had had with the Institution of Mechanical Engineers, and they were fortunate in having with them that evening the President of the Institution of Mechanical Engineers (Captain Sankey).

Captain Sankey

CAPTAIN SANKEY said he looked upon it as an honour to be asked to open the discussion at this joint meeting. He knew very little indeed, however, about this subject. His knowledge of chemistry and his knowledge of mechanical engineering just enabled him to realise the beauty and simplicity of the chemical work and also the great ingenuity of the mechanical arrangements that had been adopted to meet the requirements of this process. When he first heard of pressures of 900 atmospheres he thought it must mean the most difficult mechanical arrangements, but to his astonishment, when he read the abstract of the paper he found they were very far from that. The mechanical part was extremely simple, and to his mind that was one of the great attractions of the process. Notwithstanding these high pressures, Claude had been able to devise an extremely simple mechanical apparatus, and he had shown genius in that. Apparently the law was that the higher the pressure the greater the simplicity, although that was not altogether true because they had been told that Claude had tried 2,000 atmospheres in the laboratory without being able to work it commercially. Otherwise, if the law were continued, it would appear that at certain pressures no mechanical apparatus at all would be required. (Laughter.) He would like to ask a question about the testing of the cylinders. It had been pointed out that Hook's law was not obeyed after a certain pressure, but he would like to know if, after they had tested one of the cylinders and obtained the law of expansion, they then released the pressure and then put it on again, would the same effect occur or would Hook's law in that case be more nearly observed. He did not know whether the author had tried the experiment.

In conclusion, Captain Sankey said he would like to take the opportunity of observing how extremely important it was for mechanical engineers and chemists to hold joint meetings in that way. The admirable Crichtons who were sufficiently good chemists and sufficiently good engineers to devise the apparatus required for the chemical industry must be very few and far between. The work could only be done by eminent chemists and eminent mechanical engineers joining together to work out the plant in order to get the best results. Therefore, it was of extreme importance that these

joint meetings should be held, and he hoped they would have a further and greater connection in some sort of direction or another in future. He could not define that at the moment any more closely. They must all feel that they had heard a description of a plant which was epoch-making, and of which they would hear a great deal more in the future.

Dr. Harker's British Experiments

DR. J. A. HARKER said that, as one who had been much interested in watching the progress of the Claude process right from its earliest beginnings to the present day, he would like to take this opportunity of saying a few words. The author of the paper had emphasised some of the important differences between this process, which was described in detail for the first time, and the original Haber process, as operated by the Badische Co. While mentioning the Haber process, however, he ought to say, after some special opportunities for acquainting himself with the facts, that while it was quite true that the basic chemistry of the synthetic ammonia process was developed under Haber's general direction in the laboratories of the Technische Hochschule at Karlsruhe, yet it was in danger of being overlooked that this work was not, as was so often supposed, entirely German achievement. He felt it only his duty to state that in his view its success was in very great measure due to the brilliant researches of two Englishmen, pupils and co-workers of Haber, viz., Dr. Robert le Rossignol, who was a Jerseyman, and the late Dr. H. C. Greenwood. He hoped on some future occasion to have something more to say on these matters, but would content himself with this brief mention of it now.

Mr. West had told them that one of the most striking differences between the Claude plant for a given ammonia output, and that used in the Haber method, was that the Claude plant was very much smaller. He had stated that the space-time-yield or the amount of ammonia produced in unit time by a given amount of catalyst by the Claude process was about sixteen times as great as in the Haber method—1 litre of catalyst giving a yield of 5 to 6 kilograms per hour instead of 350 to 400 grammes. That was certainly an achievement, and in the newer French method this result was brought about mainly by the adoption of the higher working pressure of 900 atmospheres instead of 200. He would like, however, to point out that increase of working pressure was not the only method by which greatly increased yields could be obtained.

Some of those present would be aware that a long series of experiments on the problem of ammonia synthesis was carried out during the war period by the Nitrogen Products Committee under the auspices of the Munitions Inventions Department of the Ministry of Munitions. By the kindness of the Provost and Senate of University College, and especially by the enthusiastic help of Professor Donnan, the Committee's Research Laboratory was located in the new Ramsay buildings, and one of the first processes studied was that of synthetic ammonia. This was not the place to go into any details as to the results of those experiments, but he would like, as director of the laboratory, to pay a tribute to the brilliance, initiative, and perseverance of the late Dr. Harold Greenwood, to whom, along with the staff, their success was in very great measure due. By modifications of the original Haber method on lines completely different from those of Claude, the same kind of results and yields as they had heard of from Mr. West were now being obtained on a manufacturing scale. He himself said good luck to both systems. As soon as the world settled down to normal work and production, it was his firm conviction, after some considerable study of the economic situation, that the world's demand for increased supplies of cheap fertilisers would furnish an ample market for all that could be produced by synthetic and non-synthetic methods.

There was one technical point to which he would like to refer. It was said that the actual proportion of combination in the Claude process was about 42 per cent. as against 13 per cent. in the Haber process. Was the 42 per cent. a working value or an equilibrium percentage? If it were an equilibrium value then the working value was bound to be lower. He could say a great deal more, but would content himself with congratulating Mr. West on having been allowed to give in public a great deal more information than was usually vouchsafed when a technical process was in the stage of commercial exploitation. It certainly looked as if the Cumberland Coal Power & Chemicals Co. had no hesitation in placing all their cards on the table.

Another question was with regard to the series working. Was there any evidence of any difference in the percentage of the gases combined in the first, second, and third stages. Mr. West had said that there was rather over 80 per cent. combination over-all, and that by his formula he could calculate back to get the value of *a*, but had Claude made any separate determinations to see whether the yield might be greater in the first, second, or third. It was obvious that the first catalyst had to stand the rougher treatment and would have a shorter life than the others, but supposing they had a good and new catalyst in all the vessels working normally, he would like to know whether Mr. West had anything to say as to the differences in the three. He had been on a visit to the plant two years ago when Claude was withdrawing some of the actual liquid ammonia without any cooling at all, just at ordinary room temperature. Somebody distracted him a little bit and a piece of grit got into the valve. Claude opened the valve a little harder and a light stream of liquid ammonia played rather suddenly over his face and down his neck. That was a graphic way of showing that there really was liquid ammonia in the vessel. Luckily it did him no more harm than a sharp frost bite.

Lubrication Problem

MR. J. REAVELL (Ipswich), as a member of the Institution of Mechanical Engineers, supported what Captain Sankey had said about the advantage of holding these joint meetings. One important matter which appealed to all engineers was the lubrication of this apparatus. He must confess that he was a little puzzled to hear that petroleum ether was used for lubricating purposes. He supposed it was an extremely light distillate of petroleum, lighter, perhaps, than aviation spirit, and he could understand its use for cleaning a machine but not for lubrication. Perhaps it gave a film that provided the lubrication, although he should not have imagined that petroleum ether would have had much viscosity. Perhaps, however, there was a liquid film maintained in conjunction with the ingenious cup leather which had been exhibited.

CAPTAIN LIVENS asked for information as to the composition and life of the catalyst.

The Merit of Simplicity

MR. A. EGERTON said there were two ways in which a process might be made a success. One was to add detail upon detail and make it complicated, although a success, and the other was by taking off everything that was irrelevant and leaving a simple and fine process. That was what Claude had done in his process. He had watched it since 1917, and every time he had seen it, it was more and more simple.

MR. W. H. PATCHELL, who also supported what had been said by Captain Sankey, as a member of the Institution of Technical Engineers, spoke with regard to the effect of hydrogen on steel pipes. He said there had been trouble with steam steel pipes, and semi-steel pipes, in some quarters, and it had been attributed to the dissociation of the hydrogen. Could Mr. West say whether he had found anything of the sort in this plant, and whether hydrogen did act deleteriously on the steel at these high pressures?

Mr. West's Reply

MR. WEST, replying to the discussion, said he had tried repeating the test on pressure, as mentioned by Captain Sankey, and found that if he left off at a certain pressure, say to 6 tons, and then released the pressure, the pressure went back to zero. If they did it a second time, they got a straight line up to where they had left off previously, and after that, the thing began to go up again. Furthermore, if they left the pressure on for several minutes, the stretch would go on slowly and gradually diminish.

In reply to Dr. Harker, he said the values were equilibrium values, but from the test results, of which Dr. Harker was well aware, Claude must get very near the actual theoretical equilibrium, and probably nearer than did Haber with his lower pressure. Haber had published figures, and he believed the actual combination which he got was 6 or 7 per cent. With regard to separate values in each of the catalyst tubes, he was not quite sure whether Dr. Harker meant the space volume values or the actual work done in each tube. Of course, the third tube, as a matter of fact, had most of the work. The first two took a share between them, and taking 100 volumes of gas, there would be about 50 going through each tube, and taking in round figures a combination of 40 per cent., that gave 20 volumes contained in each first tube. Then they had got 60 volumes coming on to the next tube, and they had 40 per cent. of 60 in that, so that it was the third tube which

had most of the work to do. After that, it was the first two, and the fourth tube had very little indeed. He did not think Claude had made any separate determinations of the space-volume-yield for the particular tubes.

As to petroleum ether, he did not think Claude had done any viscosity determinations.

Answering Captain Livens with regard to the catalyst, he was afraid he could not give any more information as to the composition than was in the paper. As regards its life, the life was so long that the cost of the catalyst material was infinitesimal. With regard to the question raised by Mr. Patchell, and the effect of hydrogen on steel, they always used pipes of the special nickel chrome steel when the gases were hot, and they had been working without any trouble whatever.

Professor Hinchley's Plea for Publicity

PROFESSOR J. W. HINCHLEY, proposing a vote of thanks to the author, said the paper was a provocative one to some people, but unfortunately it had not succeeded in provoking them to come forward and say how they did it. He had hoped that Dr. Harker was going to say something of the way he had worked at University College, but he had not. However, the details of the Claude process had now been placed before them, and he hoped it would provoke other people to be equally open and to place all their cards on the table, because he did not think anything was lost by so doing. This paper was an example to our manufacturers not to be secretive about their work, because he imagined they would get far more benefit by being open than by being secretive. He was not suggesting that Dr. Harker was secretive, because he had not the slightest doubt that the process was not his property. He was speaking of the people who were working other processes devoted to the fixation of atmospheric nitrogen.

The vote of thanks was accorded with acclamation.

The Hampson Process for Liquid Air Production

Notes on Laboratory Scale Plant

In the following notes by J. W. Cook the design and construction of laboratory apparatus for liquefying air by the Hampson process are described, together with details of necessary or useful accessories, such as purifiers for the air, precoolers, and a high-pressure needle valve. They are taken from No. 419, Scientific Papers of the Bureau of Standards, Washington, and we are authorised to say that complete copies may be obtained free on application to the Bureau.

THE following is a brief account of the liquefaction of air on a laboratory scale by the Hampson process and a description of the apparatus now used at the Bureau of Standards. It is not the purpose of this paper to enter into the theory of the Hampson liquefier, nor to furnish a working drawing whereby the apparatus may be duplicated, because details and methods of mechanical construction are rarely duplicated exactly by different constructors. It is the purpose to show the general methods of construction which will serve as a guide for others working along similar lines.

It is well to call attention to the fact that the total cold available is determined by the initial temperature and pressure of the air at the point where it enters the regenerator and the exhaust pressure, which in practice is one atmosphere. It is independent of the internal construction or arrangement of the liquefier, of the material used in its construction, of the distribution of temperature in the regenerator coil, and of all other circumstances whatever, provided that the kinetic energies of the feed and the exhaust are negligible. This cold is used in the following three ways : (*a*) To offset the heat that leaks into the liquefier from outside, either through the insulation or along the metallic component parts of the liquefier ; (*b*) to cool the whole quantity of gas from its initial temperature to the slightly lower exhaust temperature ; (*c*) to cool a fraction of the air from this exhaust temperature to the normal boiling point and then condense it into liquid.

From these facts it is evident that to obtain the maximum amount of liquid air with a given expenditure of power a Hampson liquefier must be so constructed that the factors (*a*) and (*b*) are kept as small as possible. This results in a compromise, however, for by increasing the size of the regenerator indefinitely, which would make (*b*) negligible by exhausting at practically the initial temperature, the size of the liquefier, over all, is necessarily increased, thereby increasing (*a*) the heat leak. It is therefore apparent that, to be efficient, a liquefier should be as small, over all, as will exhaust air at a temperature just slightly below the initial temperature, which may be about room temperature or may be considerably lower if a precooler is used. The size of the regenerator coil required would be determined chiefly by the capacity of the compressor furnishing the air and by the temperature of the air entering the regenerator. Obviously, if a precooler is used, the size of the regenerator may be decreased.

In the foregoing statement it has been assumed that the liquefier has been in operation long enough for complete thermal equilibrium to have been reached. Under these conditions the actual heat capacity would not be a factor. If a liquefier is to be run only intermittently for the production of small amounts of liquid at a time, the heat capacity of the liquefier will be an appreciable factor, influencing the length of time required to cool down the liquefier when starting, and effectiveness of heat interchange can be advantageously sacrificed in order to reduce the heat capacity.

Construction of Liquefiers

In the liquefiers constructed at the Bureau the regenerator coil is a copper tube (aa′, Fig. 1) wound, starting at the top of the liquefier, in a spiral from outside to centre for the first layer, then from centre to the outside for the next layer, and so on down the liquefier, without multiplicity of tubes and without retracing in the reverse direction from bottom to top. Thus, all the incoming air must pass through the entire length of the regenerator. The spiral is wound on brass forms ; the core is then slipped out of one of the forms to permit removing the two halves of this form from the coil. The form is then replaced on the core from the other end and the winding continued, the process being repeated until the entire length of a tube, usually about 25 ft., has been wound. The several coils are then pressed down into a series of nearly flat spirals, and as many sections as are required for the regenerator are joined with silver solder. It is more convenient to make the joints at the outermost turn of the spiral. The complete regenerator coil is then mounted permanently on a German silver tube just strong enough to serve as a core and support the apparatus.

In winding the copper tubing it sometimes has a tendency to collapse or flatten. To prevent this it is convenient to fill a length of the tube with water and, with a hydraulic pump, maintain during the winding a constant hydrostatic pressure on the tube equal to the pressure at which the liquefier will be operated with air, usually 3,000 lb. per sq. in. If this process does not suffice, the tube may be filled with water, then frozen in a bath of brine and ice, and wound while the water in the tube is frozen. Annealed copper tubing will not burst on having water frozen once within it,

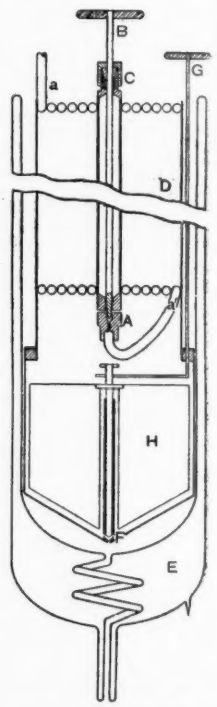


FIG. 1. — CROSS-SECTION, PARTLY DIAGRAMMATIC, OF HAMPSON LIQUEFIER.

aa,′ regenerator coil ; A, expansion valve ; B, valve stem ; C, stuffing box ; D, sheet metal casing ; E, silvered glass Dewar cylinder ; F, float valve : G, lifter for float valve ; H, flo .t.

and if winding is done before the ice has had time to melt a very true coil of small diameter may be made. Either of the above methods has the advantage that emptying and cleaning the tube are accomplished without difficulty, which is not the case if lead, rosin, &c., are used in a tube of this length. It is advisable to test the copper tubing before winding under sufficient hydraulic pressure to assure a reasonable factor of safety, and to test the completed regenerator at a lower pressure, but still somewhat higher than the normal working pressure.

At the lower end of the core is soldered the expansion valve (A, Fig. 1), and at the lower end of this is silver soldered the end of the regenerator coil. Fig. 2 is a drawing of this expansion valve in detail, it being a needle valve of simple construction. A brass body and phosphor-bronze or gun-metal needle work well. The expansion valve is operated from above the top by means of the valve stem (B), which is a German-silver tube extending up the core and through a stuffing box (C), which holds the back pressure only. Any other type of valve that can be operated conveniently may be used, however, and even a fixed orifice, in the form of a few feet of copper capillary tube, has served in place of an expansion valve with fair success. It should be noted that the liquefier which was equipped with the capillary tube in place of an expansion valve did not permit of adjustment to accommodate variations in the speed of the compressor and also gave considerably more trouble by freezing and clogging, which will be discussed later.

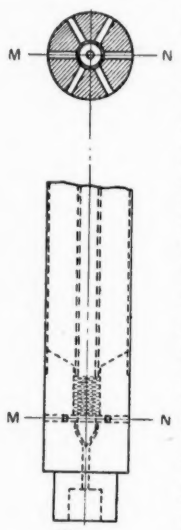


FIG. 2.
EXPANSION VALVE
(ACTUAL SIZE).

A sheet-metal cylinder (D, Fig. 1) of thin German silver is made to fit tightly around the regenerator, open freely at the top to exhaust the gaseous air, and open through a small hole at the bottom to allow the liquid air to run out.

It is desirable to mount the complete liquefier in a suitable Dewar vessel (E) having an outlet at the bottom. However, very satisfactory results have been obtained by using 3 to 4 in. of "fine regranulated cork" instead of a Dewar vessel. Fine regranulated cork is made commercially by grinding trimmings from cork board.

To work efficiently, the liquefier should discharge air in the liquid state from the bottom of the sheer-metal cylinder mentioned above, and all of the cold vapour should be forced up over the regenerator coil and out at the top. To accomplish this either a fixed, and adjustable, or an automatic outlet valve must be arranged at the bottom. A fixed opening naturally works with least efficiency, because some cold vapour escapes with the liquid and is a direct loss. An adjustable opening requires attention while running. An automatic float valve (F) can be made to give high efficiency and very satisfactory service, but care must be taken in its design. It has been found that the violent turbulence of the air around the expansion valve and in the vicinity of the float (H) may lift the float against gravity, hold the valve open, and prevent its operation. It is therefore necessary to instal baffles to screen the float. No entirely satisfactory arrangement of baffles has been found, although several layers of fine copper gauze around the expansion valve serve fairly well. It is also necessary to remove moisture which will collect at the float valve when the liquefier is not in use and which would freeze if not removed when the apparatus was put into operation. If some mechanical means (G) is provided whereby the float valve can be lifted and held open while dry air is circulated through the liquefier just before starting a run, all moisture can thus be removed and the float mechanism will be free to open and close automatically. No ferrous metal should be incorporated in this part of the liquefier, as rusting would subsequently cause trouble.

When the liquid-air plant is in operation, the air after compression is cooled with running water to approximately 20°C. Since the Joule-Thomson effect is greater at lower temperatures, it is very desirable to further cool the air before it reaches the liquefier, which is done by immersing a line of copper tubing in a tank containing ice and salt. Should a refrigerating plant producing a still lower temperature be available—using, for example, ammonia or carbon dioxide—a precooler should be included in the liquefier above the regenerator coil.

Purification of Air

It is also necessary that some means be provided for purifying the air by removing the water vapour and carbon dioxide. Most of the water vapour is condensed during compression, and a trap is located to catch this water, which can be drawn off at intervals, together with the oil used for lubrication in the compressor. The air is subsequently passed through a container, where it bubbles through a solution of sodium hydroxide, which removes carbon dioxide, and then passes over calcium chloride, which removes water vapour. This method is very effective, delivering air which is purer than is actually needed for normal conditions of liquefaction by the Hampson process. Calcium hydroxide in water (milk of lime) may be used to remove carbon dioxide, and calcium oxide (quicklime) may be used to remove water vapour, if preferred. If only one purifier is available, it can be used with dry sodium hydroxide in the lump or stick form, as this reacts with both carbon dioxide and water vapour.

These purifiers are one of the chief sources of danger in a plant of this kind, as they contain comparatively large volumes of air under high pressure. They should, therefore, be designed with a considerable factor of safety and should be tested under hydraulic pressure considerably in excess of the working pressure. Each stage of the compressor is equipped with a spring safety valve, the one on the last stage also serving as the safety valve which protects the liquefier and purifiers as well as the compressor. It is suggested that a check valve, resembling the outlet valve of the last stage of the compressor, be placed in the air line between the first purifier and the high-pressure safety valve on the compressor to prevent a possible back flow of air in case of accident to this safety valve or to the compressor outlet valve and the gasket under the high-pressure cylinder head. If they should give way while pressure is on, any solution in the purifier would be atomised into the laboratory through the rupture unless such a check valve is provided.

A purifier for removing carbon dioxide may be placed in the intake line to the compressor, but as the volume of the air in the intake line is much greater than that in the high-pressure line more surface of the reagent must be exposed. When a purifier of proper size is placed in the intake line, it is effective for removing carbon dioxide, but very unsuitable for removing water vapour, because much water can be removed during compression, as mentioned above. Should any purifier be placed in the intake line, care must be taken to thoroughly filter the air before allowing it to enter the compressor, otherwise particles of the reagent used will be carried by the current of air into the valves of the compressor, eventually causing trouble. It is desirable, if feasible, to deliver to the intake of the compressor the exhaust air from the liquefier, because this air, having passed through the purifiers, has had most of the water and carbon dioxide removed.

When starting a Hampson liquid-air plant after pressure has been built up but before any liquid has been produced, there will be a very definite rate of flow of air through the apparatus. If the liquid-air outlet valve is closed before any liquid has been produced and the high-pressure gauge is watched closely, it will be observed that there is a definite time at which the pressure drops, indicating that the air flow has slightly increased. This corresponds with the first production of liquid. The mass rate of flow of partially liquefied air is probably greater than that of gaseous air under the same conditions, owing to the greater density of liquid air. This greater density, however, is accompanied by lower velocity of flow, which favours the deposition of ice or solid carbon dioxide at the point in the expansion valve or its vicinity at which liquefaction occurs, resulting in partial or complete clogging. To remove the obstruction, it is necessary to temporarily change the point where liquefaction is taking place to a point farther on in the air current, thereby increasing the velocity at the point where clogging occurred and sweeping the obstruction from its point of lodgment. This can be accomplished by momentarily opening the expansion valve a little and then reclosing it to its proper position. If the expansion valve is frozen in place and cannot be moved, the same effect may be obtained by allowing some of the expanded air to escape directly out of the bottom of the apparatus (through the liquid-air outlet valve), thereby raising the temperature of the air in the expansion valve slightly. This causes a temporary vaporisation and a consequent increase

in velocity which will clear the valve of the accumulation of snow.

The difficulty just described does not ordinarily occur when the purifying train is in proper working order, because slight impurities will pass through the liquefier without causing obstruction and will be collected with the liquid air. Pure liquid air is clear and transparent, but when a very noticeable white precipitate is observed it may be taken as an indication that the reagents are exhausted and need to be replaced.

Description of Bureau Plant

The following brief specifications give a general idea of the size and output of the Bureau of Standards liquid-air plant. The four-stage compressor, driven by a 35 H.P. direct coupled steam engine, has a rated capacity of 75 cub. ft. of free air per minute. The container for the sodium hydroxide solution used for removing the carbon dioxide is 8 ft. long and 4½ in. in inside diameter and is placed in a vertical position, the air entering at the bottom and bubbling up through the solution. This container is nearly filled with pieces of broken marble, which cause better contact of the air with the solution and also prevent the carrying over of spray. About 1 gallon of a 25 per cent. solution is used, which half fills the container. The flanged ends are bolted on, compressing a red fibre ring, which seals air-tight. Three calcium chloride purifiers, each 3 ft. long and 2 in. in inside diameter, are used in series for removing

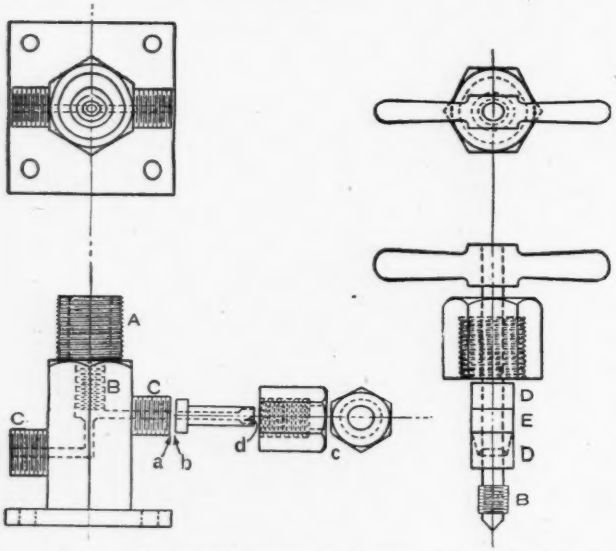


FIG. 3.– NEEDLE VALVE FOR GASES UNDER HIGH PRESSURE.

A, 1" x 14 thread; B, 7/16" x 20 thread; C, X" x 20 thread; D, brass packing rings; E, leather packing; b, c, union connexion.

water vapour. They are placed in a vertical position, and the air enters each successively from the bottom. A drain is located at the bottom of each tube for drawing off the calcium chloride solution which is formed during use. About 5 lb. of lump anhydrous calcium chloride are used to fill the three purifiers, and when replenishment is necessary only the first purifier in the series is removed and refilled. This refilled purifier is then replaced as the third one in the series, thus economising on the reagent. All the purifiers are of seamless steel tubing. Connexions to the purifiers are made by means of ball-and-socket unions of the type used on high-pressure gas cylinders.

The compressed air, after being purified at ordinary temperature, is cooled to about 0°C. by a circulation of calcium chloride brine (cooled by an ammonia plant) and then to from —20 to —35°C. by a CO_2 cycle.

The regenerator coil consists of about 200 ft. of copper tubing of $\frac{3}{16}$-in. outside diameter, and 0.035-in. wall, mounted on a ½-in. core. This coil when mounted is about 18 in. long and 3 in. in outside diameter, and is completely jacketed by a glass Dewar vessel. An automatic float-delivery valve is installed with mechanical adjustment for holding it open when desired. When working at full capacity, the plant produces 3 gallons of liquid air per hour. The general operation of the plant indicates that the above proportions are approximately correct.

Fig. 3 shows the construction of a very serviceable needle valve, which will be convenient in a laboratory where high-pressure air lines are desired for various purposes or where there is more than one liquefier available. This type of valve has been used at the Bureau of Standards for many years, but the origin of its design is not known. The body is usually of brass and the needle of steel, but where there is a possibility of the presence of moisture phosphor bronze is recommended in place of steel. The high-pressure lines are connected to the valve by means of unions, one of which is represented. A thin gasket of pressboard is placed between the flat faces (a) and (b) and compressed air-tight by the nut (c). The copper line is joined with silver solder at (d).

Acknowledgments.—Many of the features described are similar to those of other commercial liquid air plants. The development of the liquid-air plant at the Bureau of Standards is due largely to F. S. Durston and the late T. B. Ford, who were formerly in charge. Acknowledgment is also due to Dr. C. W. Kanolt, at present in charge of the cryogenic laboratory, for a careful criticism of the manuscript.

Santa Catalina Nitrate Company

Slight Improvement in Sales Anticipated

SPEAKING at the annual general meeting of the Santa Catalina Nitrate Co., Ltd., held on Tuesday, at Winchester House, London, Mr. F. G. Lomax (the Chairman) said that despite the small quantity of nitrate sold, the record profit of £46,761 had been realised, and the board had thereby been enabled to write off all arrears of stoppage of works, expenses, and repairs to plant. Considering the small quantity of nitrate taken from the grounds, it had not been thought necessary to write anything off for depreciation, but £10,000 was placed to reserve, and £6,669 was carried forward, after paying 20 per cent. for the whole year. The unfavourable factors to which he had alluded at the last meeting had become aggravated by conditions which had seriously affected almost every industry all over the world, and the consumption of nitrate had fallen far below what had been estimated. In order to support the market the Nitrate Association had undertaken not to sell until after March next at less than 14s. per quintal, but those measures had proved insufficient to remedy the situation, and as a result of further negotiation between the Pool and the Nitrate Association, an agreement had been concluded whereby, in consideration of an agreed compensation from producers to the Pool, prices had been reduced to 11s. for November to April, 10s. 9d. for May, and 10s. 3d. for June shipments. The effect of that had been to restore confidence to the extent that substantial sales had been made from the Pool stocks in Europe. So far buyers had not come forward for new nitrate, but there were grounds for expecting that some movement would be made during the next few weeks. The need for fertilisers was generally admitted, but the problem of exchange was a difficulty, and in present conditions he would not attempt any forecast as to the result of the current year's operations.

Disinfectant Manufacturers' Voluntary Liquidation

A MEETING of the creditors of the Farringdon Propellor & Engineering Co., Ltd., 39, Victoria Street, London, E.C., chemical manufacturers, etc., was held recently at the offices of Messrs. Cotman, Hooper, & Co., 10, Coleman Street, London. Mr. L. W. Millar, the liquidator in the voluntary liquidation of the company, said that in a statement showing the position of the company the assets were set down at £2,294. Against the assets there were debentures for £5,000 which had been issued to secure the bank, whose claim aggregated £3,425 8s. 6d. The unsecured liabilities of the company amounted to £5,573 9s. 8d., of which £5,011 6s. 1d. was due to the trade and £562 3s. 7d. was owing to the directors. There was, therefore, a deficiency of about £6,700. The company were the manufacturers of a preparation called "Thallassol," a disinfectant which had been manufactured by the company for many years. The business was being pushed, and the turnover was steadily increasing. It was pointed out that there was little prospect of the creditors receiving anything, as probably there would not be sufficient fully to discharge the claims of the debenture holders. The creditors decided to confirm the voluntary liquidation of the company, with Mr. Millar as liquidator.

Mann and Cook (West Africa), Ltd.

Chairman's Statement on the Position

AT the second ordinary general meeting of Mann & Cook (West Africa), Ltd., held on November 19, at Cannon Street Hotel, London, the chairman (Sir Richard A. Cooper, M.P.) said he regretted that the trading results were so unsatisfactory, but he pointed out that other companies trading in West Africa had also had bad results. Unfortunately the company was floated just at the end of the boom, and shortly before the trade depression set in.

It might be said that the judgment of the directors was lacking in foresight, but that criticism could be applied generally to directors and managers of every concern in the world. They were largely guided by the judgment of Mr. William Mann. The failure of the vendor company was most unfortunate, and reflected adversely on the general credit of this company. Seeing no indication of improvement, they introduced a drastic scheme of retrenchment. Unfortunately their difficulties had been increased by their principal bankers withdrawing their support. This took place within the last three weeks, and temporarily stopped trading. They must either sell their assets or reconstruct. The proposal to reconstruct was the one that appealed to him most strongly. He suggested they should nominate a committee of five shareholders to confer with the board as to the future of the company. They wished to have the benefit of this independent committee's views and recommendations, and then before the necessary meetings were called to carry any scheme into effect full details would be sent to all the shareholders, in order to give everyone the opportunity of fully considering the proposals that might be made. It would be a great pity, after the efforts which had been put forward and the organisation which had been created, to see this company disappear. Shareholders should give the two alternatives their most earnest consideration, and they must come to a decision and act quickly.

Shareholders' Views

The Chairman having invited shareholders' remarks, Mr. J. Hall asked if legal advice had been taken as to the position of Mr. Mann with regard to this company, and also as to the directors' liability in paying the sum of £18,000 mentioned in the auditors' report. It seemed to him that this business was simply handed over by the directors to Mr. Mann, to do what he liked with. It was entrusted to him to carry on in any way he chose, and also to do business with the company. There was no mention in the prospectus of any arrangement with Mr. Mann except that he should be managing director for life. Another suggestion was whether they should not go into compulsory liquidation, so that the most searching inquiry could be made into all the operations of the company. For an industrial company to lose £250,000 in a year and a half was an achievement it would be very difficult to equal.

Mr. Grant Hooper said that, in consequence of their bankruptcy, there seemed little hope of recovering anything from Mann and Cook. As to the future, the question was whether they could possibly, under any circumstances, carry on. The carrying on of a business of that kind involved special knowledge, and it appeared that the special knowledge in this case was wholly vested in Mr. Mann. He endorsed the suggestion that the company should go into liquidation, as the only means of recovering the slightest possible amount, and if it was possible to obtain compulsory liquidation, which would involve investigation, they would be wise to adopt that course.

Chairman's Reply to Criticisms

After hearing the views of several other shareholders, the Chairman expressed an opinion in favour of reconstruction. The difficulty would be to raise sufficient capital. The amount of the present bank overdraft was £52,000, and they would want working capital. With regard to the mixture between the firm of Mann and Cook and this company, whatever responsibility he (the Chairman) held, the shareholders held equally with him, because the position was explained in the prospectus. A remark had been made which seemed to show that the speaker thought the vendor firm had been trading on the West Coast. There was no truth in that. As far as regarded taking legal advice, they had done everything possible in that direction. Shareholders knew when the company started that the special technical knowledge was confined to Mr. William Mann and those associated with him. He felt now the unwisdom of the arrangement. Shareholders would be doing no good by putting the company into liquidation; there was reasonable hope of getting a better bargain by private negotiation. The sum of £18,000 which had been referred to was not money that had been paid by the board. There was an overdraft at the bank on the other side of that amount when the company was formed, and the board had refused to acknowledge that they were liable for it. The matter was *sub judice*.

The resolution adopting the report was carried with a few dissentients, and a committee consisting of the Hon. A. Hudson, Mr. T. L. Gilmour, Mr. J. Hall, and Colonel Josiah Wedgwood, M.P., with power to add a fifth member, was appointed to confer with the board.

Benzol Research at Leeds University

THE Joint Benzol Research Committee of the University of Leeds and the National Benzol Association has commenced its work by the choice of a research chemist, who was officially appointed by the Council of the University at its meeting on November 16. Mr. E. C. Williams, M.Sc., who has received this appointment, graduated in 1914 at the University of Manchester at the head of the First Class Honours List in the School of Chemistry. He was awarded the Mercer and Dalton Research Scholarships for research theses, and a special University prize for Physical Chemistry. After two years' service in the Army, where he attained the rank of captain, Mr. Williams was appointed research chemist to the British Dyestuffs Corporation, Ltd., and during the past four and a half years has been engaged as head of the intermediates department at the Dalton Works, Huddersfield. Mr. Williams will work in the Department of Coal, Gas, and Fuel Industries at the University of Leeds, and as far as may be found desirable on plants engaged in benzol production and laboratories attached thereto.

"Who Told You That?"

SELECTIONS from the stories collected by "Quex," which have been appearing under this title for some time in *The Evening News*, have been published in a neat little pocket volume (Stanley Paul & Co., pp. 149, 2s. 6d.), and a very good collection they make. There are very few "chestnuts" among them; the wit is delicate and never coarse; they are refreshingly modern—one might almost say post-war—in their modes of expression and point of view; the style is natural and unforced. A very ready help in time of need for the after-dinner speaker who relies upon his memory for his wit.

A companion volume, issued by the same firm, under the title "Sunbeams" (pp. 186, 2s. 6d.), is made up of stories which have appeared in the *Sunday Express*. These are drawn from a much wider field and are not so strictly limited to contemporary times and manners. Most of them are associated with well-known public figures, past or present, and assume some knowledge of their characteristics—though this is not always necessary to their appreciation. Short, pointed, and entertaining, they make a handy dictionary of the kind of witty personal incident or repartee which one so often forgets just when one wishes to remember it.

Recent Wills

Mr. T. M. Oldham, J.P., of Coventry Street, Southam, Warwick, for many years identified with the manufacture of lime and cement ..	£27,172
Mr. R. F. Roper, of Lower Standary, Elburton, Devon, chemist	£8,555
Mr. A. Noble, of 34, Lauder Road, Edinburgh, a member of the Pharmaceutical Society....	£38,283
Mr. A. McNab, J.P., of Middleton Kerse, Menstrie, Kinross, for some years President of the Clan McNab Association, a director of the Distillers Co., Ltd., the British Burmah Petroleum Co., Ltd., the Arizona Copper Co., the Esperanza Copper and Sulphur Co., Ltd.	£43,113
Mr. J. H. Dakin, of Edwardes Square, Kensington, governing director of Dakin Brothers, Ltd., wholesale druggists, Middlesex Street, E	£41,045
Mr. G. H. Jones, of Blackpool, machinery and metal merchant	£14,654

Lagunas Syndicate

Sir Robert Harvey on the Nitrate Position

In the course of his speech at the twenty-sixth annual meeting of the Lagunas Syndicate, Ltd., held on Tuesday at Winchester House, London, E.C., Sir Robert Harvey (the chairman) said that manufacturing operations were carried on satisfactorily to the end of March in the case of North Lagunas, and to the end of May at South Lagunas, when the enormous accumulation of stocks and the impossibility of disposing of them compelled them to discontinue manufacturing operations. This enforced closure entailed a great deal of expense, but it was carefully carried out and all the necessary steps taken adequately to protect the oficinas. During their working period the oil installations were completed, and due attention paid to the proper upkeep of both plants. In March last the iodine experts visited the Company's works to revise their quotas, and the new quotas allocated were satisfactory.

Dealing with curtailment of output, Sir Robert said that in October, 1920, the actual production of nitrate of soda was 5,076,249 quintals, whereas last month it was only 1,613,253 quintals, and even this quantity, if the coast stocks were to be reduced to a normal figure, was a great deal too much. What was really needed was a total closure for at least six to nine months, but unfortunately this was practically impossible, owing to the fact that the production of nitrate of soda was Chile's staple industry, and the complete withdrawal of all the men engaged therein would probably lead to a serious labour crisis in that country.

Referring to the agreement between the Pool and the Association, Sir Robert Harvey said the Pool immediately reduced its quotations and had now succeeded in selling about 190,000 tons of nitrate. They had still, however, considerable quantities to dispose of, and he did not think they could contemplate any further shipments to Europe before June next. Unfortunately, last season's small demand was not restricted to Europe, the consumption in the United States and other countries falling considerably below estimates. It was not easy to gauge at this date what improvement might be expected in the forthcoming season. Generally, the prospects were brighter and the stocks in the hands of the dealers should be absorbed. In America further nitrate would certainly be required. Under no circumstances, however, could the stocks in Chile be materially reduced, and on June 30 next there would probably be a surplus over and above normal stocks of from 33 per cent. to 50 per cent. of the 1922-23 probable consumption; consequently the production for that year would have to be materially curtailed. Personally he did not look for any betterment of the conditions until after June, 1923. In view of the fact that sulphate of ammonia was their chief competitor, and that Germany was producing very large quantities of this commodity, it would appear as if some working arrangement on the lines of the recent conference between the British Sulphate of Ammonia Federation, the Nitrate Producers' Association, and the German Stikstoff Syndicate, might be entered into for at least one year.

Discussing the use of nitrate as a fertiliser, Sir Robert said that if only a very small part of the world's areas were suitably treated a market could easily be found for much larger quantities of nitrate of soda than could ever be shipped, and for more of its rival fertilisers than could be produced. In this connexion it was interesting to note that the failure of last year's American cotton crop was attributed to the lack of nitrate of soda. These results were not limited to cotton and could be confirmed by agriculturists throughout the world.

In conclusion, Sir Robert said it was certain that dividends would be smaller, and might even not be forthcoming, next year, but shareholders in other industrial concerns were not likely to fare much better, and later on companies with good grounds and well-equipped works should easily be able to make returns equal to if not better than those of pre-war days.

Co-operation between Rubber Associations.

The initial meeting of the Combined Committee of representatives of the Rubber Growers' Association and the Rubber Shareholders' Association was held on Tuesday in the Council Room of the Rubber Growers' Association, when a preliminary discussion ensued as to the methods to be adopted in order to secure co-operation between the two associations.

Canadian Hospitality

In his "London Letter" to *The Journal of Industrial and Engineering Chemistry* Dr. Stephen Miall writes: "The small party of the Society of Chemical Industry who visited America recently have now returned to their native country and have been very much pleased by their visit. Their lack of numbers is a symptom of the difficult times in which we live and is no criterion of the interest and affection we have for our first cousins in Canada and our second cousins in the United States. The travellers seem to have had a strenuous time—a crowded hour of glorious life—and saw much to interest them and stimulate their activity. Those I have spoken to, or rather listened to, are full of praise for the excellent organisation of all the details of the meetings, for the splendid hospitality they enjoyed, for the kindly spirit of co-operation displayed. You and your colleagues did all that was possible to make our party happy, though I gather from Sir William Pope that this necessitated an occasional evasion or even breach of the law. Pascal, who was not only a man of science, but also a philosopher, said that great men had the supreme pleasure of being able to make others happy and he told a young man that if he did this and no more he might lose the life eternal, but at least he would be damned like a gentleman."

Hull Chemical and Engineering Society

At a meeting of the Hull Chemical and Engineering Society held on November 15, Mr. A. R. Warnes, A.I.M.E, delivered an informal address on "The Insulation of Electrical Machinery." In the absence of Mr. A. R. Tankard. F.I.C. (President) the chair was taken by Mr. T. G. Leggott, M.I.M.E. Mr. Warnes first dealt with the various types of fibre used and outlined their respective merits. He further touched upon insulating varnishes, contrasting the properties of the different oils, gums, and bituminous compounds, and referred to the important bearing they had upon the disintegration and water resisting properties of the fibres, also the voltage puncture pressure. The results of defective insulation with special reference to armature winding were also dealt with. A discussion followed, in which Messrs. F. Stevenson, A. W. Purchas, H. R. Wood, W. B. Duffill, and T. G. Leggott took part.

Cleveland Technical Institute Bulletin

The Cleveland Technical Institute, Middlesbrough, which was only opened in September last, has already issued the first number of its monthly bulletin. This contains condensed abstracts of a large number of scientific and technical articles, classified under the heads of various industries, and as the matter is printed on only one side of the pages the abstracts may be filed on the card index system or pasted into a reference book. The first number contains abstracts from Belgian, French, German, American and Spanish publications, in addition to the leading British technical journals.

Graduated Instruments for Volumetric Analysis

In order to ascertain the accuracy of the cheapest quality graduated glassware which they manufacture and supply under "Grade C" quality, A Gallenkamp & Co., Ltd., of Sun Street, Finsbury Square, E.C. 2, recently took from their stock at random 238 burettes, pipettes, &c., which were submitted to the National Physical Laboratory for test. According to the National Physical Laboratory's report, out of the 238 pieces sent, 166 articles came within either the Class A or B limits of tolerance which they allow. The firm state that the full report of the National Physical Laboratory is open to inspection at their offices.

Lord Leverhulme on Trade

Speaking at the annual dinner of the London Commercial Travellers' Benevolent Society, on November 18, Lord Leverhulme said he felt confident that trade was reviving. We should never get good trade by talking bad trade. All our difficulties, he said, could be overcome by indomitable British pluck, but until there was a restoration of the exchange of British-made commodities with commodities made on the Continent we could not have successful trade or commerce, and the sooner we recognised that fact the better. Business was entirely a matter of confidence. To ensure a return of prosperity to this country we must have increased output.

Investments in Radium Mines

Defendant's Appeal Allowed

In the Court of Appeal last week Lord Justice Bankes and Lord Justice Scrutton allowed the appeal of Mr. Frederick March, who was one of the defendants in an action brought by Dr. A. H. Thomas, against Harding Brothers (Engineers, Westminster), Ltd., and Mr. Harry March, and the appellant for damages for the return of £375 which the plaintiff in the action said was obtained from him by fraud and misrepresentation. The action came before the Lord Chief Justice and a special jury, and judgment was entered for the plaintiff for £950 and costs.

The appellant now asked for judgment or a new trial, and contended that he was not liable for misrepresentations made by an agent of the defendant firm without his knowledge.

According to the plaintiff's case, the defendants March, who were directors of the Company, advertised in March, 1916, for financial co-operation to the extent of £5,000 in a business of world-wide importance. Replying to the advertisement, the plaintiff was told that the company had discovered and owned radium mines in Portugal in which they had invested large sums, and that the ore from these mines was the richest in the world.

In July, 1916, a Mr. Magan, another director of the defendant company, told the plaintiff that the Toluene Syndicate, Ltd., had a contract to supply toluene to the Government, that the company had special processes for making superior qualities of aniline dyes, and that the Government was in partnership with the defendants and the Toluene Company, and had advanced £40,000 to build and equip a factory at Whitehaven. In September, 1917, the plaintiff was told by Mr. Magan that one Oddy had patented processes for aniline dyes and other products of coal tar, especially petrol, and that such petrol was of better quality than any other. The plaintiff, believing these representations, made payments of £375.

According to the defendants' case, the two Marchs were engaged in prospecting for radium in Portugal, both before and after 1911. They secured many mining concessions which they regarded as valuable. The Portuguese Mining Syndicate was formed, with a capital of £12,000, and by 1914 it was well known on the Continent that it was making extensive experiments with radium ore.

Giving judgment, Lord Justice Bankes said that in this case there was no evidence whatever that the defendant Mr. Frederick March was in any way responsible for what his co-director Magan said with reference to the company. The evidence given in support of the plaintiff's case was no real evidence that the property was of no value, or that the statements were untrue, or so untrue that no honest man would make them. The judgment against Frederick March must be set aside, and judgment entered for him, with costs.

Lord Justice Scrutton concurred.

Manure from Sewage Sludge

At a meeting of the Birmingham Tame and Rea District Drainage Board on November 17, it was reported that in November, 1920, the Board authorised an agreement to be entered into with Organic Fertilizers, Ltd., for dealing with sludge (converting it into patent manure) produced at the sewage works. Owing to delay in the formation of the company the agreement was not completed, but the committee were now informed that the matter was likely to proceed. The committee agreed that the agreement should continue, but stipulated that the plant should be erected and at work not later than Michaelmas, 1922. It was proposed that the site of the company's works should be changed from the Railway Triangle, Water Orton, to an adjacent area, lying between the River Tame and the Midland Railway.

The White Lead Conference

At the sitting of the International Labour Conference at Geneva on November 16 the proposed prohibition of the use of white lead in painting was discussed. Sir Kenneth Poadby submitted the report of the White Lead Committee, which it will be remembered, was adopted by a majority of one. The minority report was also submitted, and a long debate ensued. After an adjournment a compromise was arrived at on November 18 when an amendment providing for the prohibition of white lead only in interior painting. It is reported that this prohibition will not come into force until six years after the present session of the Conference.

Japanese Chemical Trade

Increasing Local Production

In spite of the increased production of machinery in Japan, the import trade continues to grow, and it is safe to prophesy that the more her industries develop the more machinery will she purchase from abroad, as it will be a long time before she is in a position to supply all her requirements, states the report on the Commercial, Industrial and Financial Situation in Japan and Her Dependencies in 1920, and up to June 30, 1921 (H.M. Stationery Office, price 2s. net).

As was the case in other lines, the report states, there were very heavy speculative importations of chemicals and drugs, and large quantities have had to be re-exported, while big stocks still remain in the country. The principal item in the list is morphine. This drug was imported in 1920 to the value of over 12 million yen, but the question of why it is bought and its ultimate destination is more political than commercial. There was a considerable import of formalin for use in the silk industry, but on account of the slump in raw silk, large stocks have been carried over. If, it is stated, the new system of disinfection of bristles with formalin is generally adopted a brisk demand should arise.

As regards industrial chemicals, it is interesting to note that the import of over 11 million yen of caustic soda and soda ash was equally divided between the United States and the United Kingdom. Prior to the war this had been an entirely British trade, but naturally while the export prohibitions were in force the British product, although much sought after, could with difficulty be obtained, and America secured four-fifths of the trade. The Japanese production of caustic soda has increased considerably, and in order to protect this industry the import duty has been doubled, but soda ash will have to continue to be purchased abroad. Trade with Africa has been developing.

The manufacture of chemicals and drugs progressed considerably during the war, especially in regard to chlorate of potash and phosphorus, of which there is a great consumption in the match industry, but one of the most arresting features has been the enterprise shown by the Hoshi Pharmaceutical Company, of Tokio, a concern with a capital of 20 million yen, which specialises in the manufacture of alkaloids. This company has bought over 800,000 acres of land in Peru, on either side of the Rio Huallaga on the Pacific slope of the Andes. Here coca and cinchona are grown for use in the Tokio factory.

Revival in Hungarian Chemical Industry

A report on the Hungarian chemical industry, read at a recent meeting of the National Society of Hungarian Chemical Products' Manufacturers, according to *L'Industrie Chimique*, states that of the 254 chemical works formerly operating in Hungary there are now only 175, but it is hoped that before long new productive branches will be formed. It is stated that in spite of almost insurmountable obstacles, the Hungarian works during the last few months have not only met home demands, but have also been able to export chemicals of considerable value. Although Hungary has lost her salt and explosive works, the report states that the chemical industry, as a whole, shows distinct signs of revival.

New Metal for Precision Balances

According to *La Revue Industrielle*, a new metal containing nickel as the base is being produced in France by the Cammentry-Decazenville Metallurgical Works for use in spiral springs, pendulums, graduated scales for instruments, balance beams, &c. It is claimed for the new alloy that its expansion is practically zero, being seventeen times less than that of steel, and about the same as for melted quartz. It is further claimed to be non-magnetic and rustless.

Frankfurt Exhibition, 1922

The German Minister of Justice has announced that, under the law of March 18, 1904, any invention, design, model, or trade-mark exhibited at the exhibition at Frankfurt on April 2—8, 1922, will not prejudice the obtaining of a patent for the invention, or the registration of the design or trade-mark, if the application for the patent or registration is made within six months of the date of the exhibition, and such applications will receive priority.

From Week to Week

SIR JOSIAH STAMP, secretary of Nobel Industries, Ltd., has been appointed a member of the Council of the Chartered Institute of Secretaries.

The *Vossische Zeitung* reports that DAMAGE ESTIMATED AT 300,000 MARKS was caused by a fire at the Frankfurt Works of the Griesheim Elektron, Ltd.

It is reported that the Japanese rights of THE CLAUDE PROCESS for the production of synthetic ammonia have been acquired by a Japanese syndicate.

It is reported from Berlin that AN EXPLOSION occurred on Monday at the Ludwigshafen Works of the Badische Anilin und Sodafabrik. Several casualties are reported.

The death has occurred at Woodthorpe, Esplanade, Greenock, of MR. EDWARD WILSON, a partner in the firm of E. Wilson, jun., & Co., salt merchants, Stockwell Street, Glasgow.

The Chesterfield magistrates, on November 19, assented to an application on behalf of Nobel Industries, Ltd., for the establishment of an EXPLOSIVES FACTORY at Heath, near Chesterfield.

THE ANNUAL DINNER of the Sheffield Association of Metallurgists and Metallurgical Chemists will be held at the Royal Victoria Hotel, Sheffield, on Friday, December 2, at 7.30 p.m.

The Council of the Institute of Chemistry have decided to add SWANSEA UNIVERSITY COLLEGE to the list of institutions recognised by the Institute for the training of candidates for its examinations.

The strike of RUBBER WORKERS in Lancashire against an extension of the working week from 47 hours to 52½ has been settled by the workers' acceptance of a 48-hour week with a wage reduction of 7½ per cent.

The WAR MEMORIALS of the Institution of Mining and Metallurgy and the Institution of Mining Engineers were unveiled at Cleveland House, 225, City Road, E.C. 1, on Thursday by Field-Marshal Lord Haig.

It is announced that Sir John Cadman has been appointed CHIEF TECHNICAL ADVISER to the Anglo-Persian Oil Co., Ltd., and that he is now on his way to the United States, where he proposes to examine the latest American oil practice.

At a meeting of the Llanelly Harbour Trust on Monday the chairman announced that a feature of the export trade for the month of October was the RESUMPTION OF PATENT FUEL EXPORTS, 500 tons having been shipped by the Reliance Fuel Co., Ltd.

MR. R. H. DE GREEFF, president of R. W. Greeff & Co., Inc., of New York, left America on November 5 for a three months' European trip. He will visit the London office of R. W. Greeff & Co., Ltd., and will leave later for the Continent.

Papers on "The Action of Nitric Oxide on the Metallic Carbonyls" and "Some Researches on the Metallic Carbonyls," both by R. Mond and A. Wallis, will be read at the meeting of the Chemical Society at Burlington House, Piccadilly, London, on December 1.

The usual monthly meeting of the CHEMICAL INDUSTRY CLUB, London, was held on Monday, when Dr. W. R. Ormandy occupied the chair. Mr. Paul Tingey gave an interesting address on "The Future Prospects of Palm Oil," and opened a discussion, which was carried on by the Chairman, Dr. Rule, Messrs. Ford, Craven, Brewis, Thornley, Trim, Coley, and others. A discussion took place on Club matters.

The next meeting of the Society of Public Analysts will be held on Wednesday, December 7, at 8 p.m., at the Chemical Society's Rooms, Burlington House, when the following papers will be read: "The Inks of Ancient and Modern Egypt," by A. Lucas, O.B.E., F.I.C.; "The Estimation of Small Quantities of Antimony in Copper and Brass," by B. S. Evans, M.B.E., F.I.C.; and "Notes on the Analysis and Use of Red Squills in Rat Poison," by C. L. Claremont, B.Sc., F.I.C.

A meeting was held at Liverpool University on Thursday to consider the Pharmacy Amendment Bill. The Liverpool branch committee of the British Association of Chemists points out that the Bill, if carried, will place in jeopardy the right of a large number of CHEMISTS IN WORKS and other places to call themselves by their rightful title, and Thursday's meeting was to consider what action should be taken to safeguard the interests of members of the British Association of Chemists.

An informal dinner of the Science Branch of the KING'S COLLEGE OLD STUDENTS' ASSOCIATION was held on November 11 at King's College, London. Among those present were Messrs. E. Hinks (chairman), R. J. Browning (hon. treasurer), R. L. Collett, W. D. Dick, H. Moore, P. H. Kirkaldy, J. S. W. Marlow, L. M. Nash, Professors W. T. Gordon and S. A. F. White, and Misses A. R. Stratford (hon. secretary), J. L. Thormen, and D. I. Dawson. The dinner was followed by an impromptu concert.

Speaking at the first annual meeting of the British Sulphate of Ammonia Federation, Ltd., held at 30, Grosvenor Gardens, London, on November 17, Mr. D. Milne Watson said they sympathised with SULPHURIC ACID MAKERS, but despite their difficulties the Federation felt that an attempt had been made to hold up prices above an economic level. That attempt had failed, and he thought that acid makers were beginning to realise that the chemical industry could not pay £5 or £6 a ton. They believed that sulphuric acid could be sold to-day at 60s. per ton without loss.

The Council of the Incorporated Sanitary Association of Scotland has published a memorandum of disinfection and disinfectants, in which it is stated that many substances sold as disinfectants are disinfectants in name only; they may be antiseptics capable of preventing the growth and increase of germs, or merely deodorants, but they are incapable of killing germs, and are not, therefore, true disinfectants. It is intended to prepare a list of APPROVED CHEMICAL DISINFECTANTS with a note of the strength in which each is effective. In this connexion it will be necessary for manufacturers to submit their wares to the Association for analysis.

At a meeting of the Dudley Trades Council on November 17 a letter was read from Mr. W. Bradford, general financial secretary of the NATIONAL FLINT GLASS MAKERS' SOCIETY intimating that the members of the local branch had decided not to appoint delegates to the Council or to a Conference under its auspices. Mr. Bradford added that he believed the Trades Council was founded for the specific purpose of dealing mainly with trade questions, especially in the interests of the workers, but unfortunately the members of the local branch of the National Flint Glass Makers' Society, including himself, had seen an undesirable growth of political influence in the movement. The withdrawal was accepted.

We regret to announce the death on Monday at Swansea, following an operation for appendicitis, of MR. SIDNEY CROOK, Chief Chemist to W. G. Gilbertson & Co., Ltd., of Pontardawe. After having worked with Mr. Seyler, the Borough Analyst of Swansea, Mr. Crook entered Messrs. Gilbertson's works in 1914, where, for four years, he occupied the position of Chief Chemist. He was responsible for much original work in connexion with tinplate fluxes and with basic slag, and as a result of extensive experiments at Pontardawe a patent was applied for. The late Lord Kelvin's attention was called to one of the fluxes resulting from Mr. Crook's experiments, and it was thought to be of considerable value to the tinplate industry. Mr. Crook, who was forty years old, leaves a widow.

The Secretary of the Board of Education, Whitehall, London, S.W. 1, announces that the Institute of Chemistry has consented to co-operate with the Board in arrangements for the AWARD OF CERTIFICATES in chemistry and applied chemistry to students in technical schools and colleges in England and Wales. Under the agreement certificates will be issued jointly by the Institute and the Board on the successful completion of approved courses. The scheme will provide both for full-time students and for part-time students. Detailed arrangements for the administration of the scheme will be given in rules which are now in course of preparation and will be published shortly. The Board understands that the Institute will consider at a later date whether and how far the training and the higher certificates may qualify for admission to the examination for the diploma of associateship of the Institute. Should the authorities of any school in England desire further information, their inquiries should be addressed, pending the issue of the rules, to the Expert Inspector to whom the chemistry courses of the school are assigned for inspection. Inquiries from the authorities of schools in Wales should be addressed to the Permanent Secretary, Welsh Department, Board of Education, Whitehall, London, S.W. 1.

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Abstracts of Complete Specifications

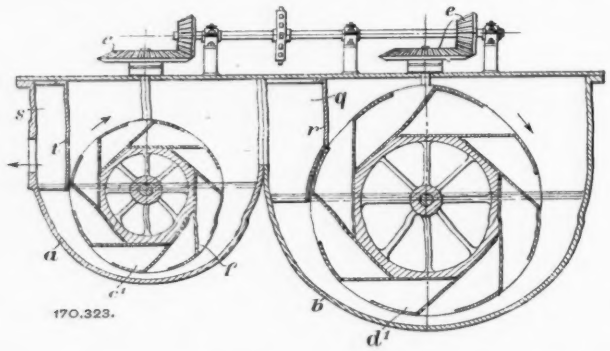
170,313-6. Artificial Silk, Manufacture of. E. Bronnert, 1, Quai du Barrage, Mulhouse, Alsace. Application dates, May 10 and May 17, 1920.

170,313. A precipitating bath for use in the manufacture of artificial silk threads, films, strips, &c., from viscose solutions, is composed of a concentrated solution of common salt, or of "Stassfurt waste salt," which is a mixture of common salt, potassium sulphate, and magnesium chloride, to which sulphuric acid is added. This bath may be used at ordinary or at moderately raised temperatures, and has the advantage that no acid vapour is given off and the machinery is not attacked.

170,316. The process is for the recovery of the salt abstracted by the threads from the bath in which the viscose silk is spun. This salt, which consists of sodium sulphate, is not readily dissolved by lixiviating in water, but it is found that if, instead of water, dilute sulphuric acid is used, the sulphate is converted into the more soluble bisulphate and readily dissolved. The hot concentrated solution of the bisulphate is added to the spinning bath to regenerate it.

170,323. Recovering Gases which have been Absorbed by Solids. Thermal Industrial and Chemical (T.I.C.) Research Co., Ltd., and J. S. Morgan, 52, Grosvenor Gardens, London, S.W. 1. Application date, May 21, 1920.

Substances such as charcoal and alumina have the property of absorbing certain gases at one temperature and yielding them again at a higher temperature. This property may be used for absorbing ethylene from coal gas and then recovering the ethylene by heating the solid. It is found that, owing to the bad heat conductivity of charcoal and alumina, difficulties are experienced in heating and cooling the material. The present invention consists in effecting the necessary heating and cooling by passing the absorbent through a molten metal. The material is preferably passed first through a bath of molten alloy heated to about 120°C., which expels the carbon dioxide but not ethylene, and is then passed

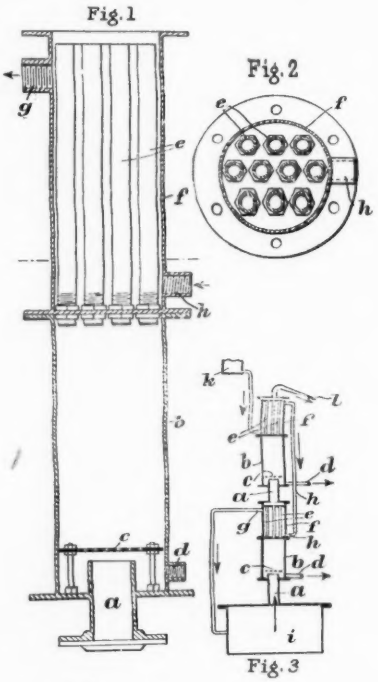


170,323.

through a second bath of molten lead heated to about 350°C., which expels the ethylene. The absorbent is cooled by returning it through the bath of alloy, and finally through a bath of mercury. The two baths *a*, *b*, contain the alloy and lead respectively, and each contains two drums *c* and *d* mounted on horizontal shafts and driven in opposite directions in each bath by gearing *e*. The material is carried in succession through the baths *a*, *b*, and is then returned from *b* to *a* by the other pair of drums. The illustration shows a vertical section through the return drums. The material is carried below the surface of the metal for the required time by the scoops *f* and is delivered into a compartment formed by partitions *q* and *r* and thence to the bath *a*, where the material is cooled and finally delivered to a compartment formed by partitions *s*, *t*. The apparatus may also be used for treating the charcoal used in preliminary absorbers for removing benzene.

170,324. Fractional Distillation, Method of and Apparatus for. Thermal Industrial and Chemical (T.I.C.) Research Co., Ltd., and Sir A. M. Duckham, 52, Grosvenor Gardens, London, S.W. 1. Application date, May 21, 1920.

The apparatus is for fractionally distilling a mixture, the liquid to be distilled being used in the condenser in such a manner that it undergoes partial fractionation without mixing with the vapour in the condenser. The apparatus is particularly suitable for the distillation of tar. The column of a still comprises a dephlegmator chamber *b* filled with Raschig rings supported on a perforated plate *c* above the vapour inlet. This chamber is surmounted by another chamber having vertical tubes *e* passing through it. The liquid to be distilled passes into the chamber *f* at *h*, receives heat from the tubes *e*, and passes out at *g*. The vapour from the still undergoes a preliminary fractionation in the chamber *b* and the condensate which collects at the bottom is withdrawn through the outlet *d*. Some of the vapour is condensed in



170,324.

the tubes *e* and the remainder passes on to the chamber *b* of the next section. The liquid and vapour withdrawn from the outlet *g* are caused to pass through the chamber *f* of the next lower section. The arrangement for distilling tar is shown diagrammatically. The tar passes from a tank *a* to a casing *f*, where it is heated, and thence through a pipe *h* to the next lower casing *f*, and thence by the pipe *g* to the still *i*. The vapour from the still passes through the pipe *a* to a dephlegmator *b* and condenser tubes *e*, and thence to another casing above. The vapour finally passes through a pipe *l* to a condenser, and two liquid condensates are also collected from the pipes *d*. The temperature of the tar in the upper casing *f* is maintained at 85°C. by a thermostat which controls a by-pass, and the temperature is maintained at 180°C. in the lower casing *f* in a similar manner by a thermostat which controls a by-pass between the pipes *h* and *g*.

170,329. Urea from Cyanamides, Process for Producing. E. Lie, and A/S North-Western Cyanamide Co., Odda, Norway. Application date, June 16, 1920.

Cyanamides are converted into urea by heating with water-soluble neutral or basic salts of the alkalies or alkaline earths. It is found that the yield of urea varies with the temperature, the amount of water, the proportions of the cyanamide and the salt, and the time of the reaction. The salt used is preferably calcium nitrate, and it is found that between temperatures 80°C. and 100°C. the greater portion of the nitrogen is obtained as urea. If higher temperatures are used together with large amounts of water the yield of urea is decreased, and the proportions of ammonia and dicyandiamide are increased.

The proportions of the latter may, however, be reduced by reducing the amount of water and the time of the reaction. In an example, a mixture of 100 parts of calcium cyanamide, 100 parts of crystallised calcium nitrate and 20 parts of water is heated to 125°-130°C. for one hour. The yield of urea is 83 per cent of the theoretical. To obtain a complete conversion into urea a sufficient proportion of water is necessary, and it is preferred to use 20 to 80 parts in the above reaction and a temperature of 80°-130°C. The time of the reaction varies from fifteen minutes to six hours. It is found that the formation of urea is facilitated by supplying the necessary water in the form of steam, and by effecting the reaction under pressure. A small proportion of a catalyst such as an oxide, hydroxide, or salt of iron, manganese, or other metal other than an alkali or alkaline earth metal, may also be used. This process results in the production of a valuable nitrogenous fertiliser which is obtained in a dry form which may be brought into a granular condition by known methods of working. Further, the salt used for the conversion of the cyanamide (calcium nitrate) is also a fertiliser.

170,351. Artificial Resins, Manufacture and Production of. J. Y. Johnson, London. (From Badische Anilin & Soda Fabrik Ludwigshafen-on-Rhine, Germany.) Application date, July 13, 1920. Addition to 146,498.

Specification No. 146,498 (*see* The Chemical Age, Vol. III., p. 354) describes a method of producing resins by condensing monocyclic ketones with alkaline condensing agents under certain conditions. It is now found that resins with similar properties are produced by using neutral or mineral acid condensing agents. In an example a mixture of cyclohexanone 10 parts and aqueous or alcoholic sulphuric acid of 50 per cent. strength 20 parts, is boiled for two days under a reflux condenser. Any residual cyclohexanone is removed by means of steam, and the resin removed and washed with water, and finally melted to expel volatile substances. The resulting resin is soluble in benzene, linseed oil, &c., but not readily soluble in alcohol. In another example, a mixture of cyclohexanone 100 parts, and zinc chloride with or without a small proportion of hydrochloric acid 50 parts, is heated to 140°-170°C. and the resulting resin separated as before.

170,431. Pigments. J. C. Smith, 49, Glenmore Road, Belsize Park, London, N.W. 3. Application date, August 4, 1920.

The process relates to the incorporation of barium sulphate with pigments in such a manner that defects such as low opacity and staining power, high specific gravity, crystalline structure, and tendency to settle out of suspension in a vehicle, are corrected. It is found that the quality of the pigment is improved if the barium sulphate is produced by chemical precipitation in the presence of the pigment, and the slower the precipitation the higher the quality of the product. If dilute sulphuric acid is added to a cold solution of barium chloride containing not more than 1 gramme per litre, the barium sulphate is not precipitated, but remains suspended in colloidal form. If, however, a finely ground pigment is also present, the barium sulphate is carried down with it. It is also found that in the case of crystalline pigments, such as lead sulphate or antimony trioxide, the introduction of amorphous barium sulphate increases the physical affinity of the pigment for linseed oil and other paint and enamel vehicles. In the case of pigments of high specific gravity, the tendency for the pigment to settle out of suspension is reduced. In the case of pigments having a high refractive index a comparatively large proportion of barium suphate may be added without disadvantage. Pigments such as zinc oxide are rendered more resistant to acids and chemical vapours by incorporation with barium sulphate. In an example, a suspension of 100 lb. of antimony oxide in 100 gallons of water is mixed with a solution of 21 lb. of barium chloride in 2,000 gallons of water. A solution of 32.5 lb. of Glauber salt in 10 gallons of water is then added during about 1 hour, and the temperature is gradually raised with stirring for several hours. The precipitate is then filtered off, washed and dried. The use of very large quantities of water may be avoided by precipitating the barium sulphate in successive stages. The precipitating agent may be sulphuric acid or a soluble sulphate such as magnesium or sodium sulphate. The barium solution should remain in contact with the pigment for not less than 6 hours and the temperature should not exceed 60°F. during precipitation, though it may subsequently be raised to about 90°F. to facilitate filtration.

170,474. Fertilisers, Manufacture and Production of. J. Y. Johnson, London. (From Badische Anilin & Soda Fabrik, Ludwigshafen-on-Rhine, Germany.) Application date, September 8, 1920.

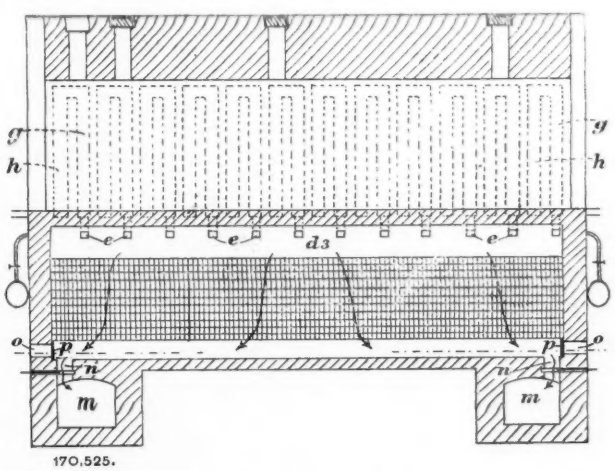
The process is for producing a compound fertiliser from ammonium nitrate and ammonium sulphate. The two salts are mixed together in the solid state and may be in approximately equal proportions, or with not less than 75 parts by weight of ammonium sulphate for each 100 parts by weight of ammonium nitrate. The quantity of moisture present must be between 3 per cent. and 5 per cent. of the mixture, preferably not more than 4 per cent., and it may be present in either or both of the salts. The resulting product is a dry, non-hygroscopic salt which is suitable for spreading purposes.

170,515. Ovens for Producing Gas and Coke. H. Koppers, Moltkestrasse, 29, Bochum, Germany. Application date, December 6, 1920.

Horizontal coke ovens of rectangular cross section are usually arranged side by side and are heated by combustion chambers arranged in the dividing walls. The fuel gas is admitted into the combustion chambers at the bottom so that there is a gradual decrease of temperature from the bottom towards the top. This arrangement is advantageous for a large output of by-products, but if the ovens are high, the coal in the lower portions is frequently overheated before that at the top is sufficiently distilled. This result is mainly due to the lower rate of transfer of heat at the top from the cooler gases in the combustion chambers. In the present invention, these difficulties are avoided by decreasing the cross section of the oven in successive stages from the bottom to the top. The decrease in width is made approximately proportional to the decrease in temperature in the combustion chambers, while the width of the combustion chambers increases correspondingly. This construction enables the horizontal flue above the oven to be made with very thick walls so that conduction of heat from the combustion chamber is minimised and overheating of the distillation gases is avoided. This construction also enables the arched roofs over the horizontal gas flues and the combustion chambers to be made of uniform span so that the strains due to heat expansion are uniformly distributed.

170,525. Coke Ovens. R. Cravau, 320, Rue des Allies, Brussels, Belgium. Application date, January 4, 1921.

The ovens are arranged parallel to one another and are separated by heating flues in the dividing walls, while a regenerator is provided beneath each oven. The illustration shows a vertical longitudinal section taken through an oven and



170,525.

its regenerator. A free space d^3 extends along the full length of the regenerator above the heat-retaining material. Every alternate regenerator is connected by ducts *e* with the heating flues *g* on either side of it, and the other alternate regenerators are similarly connected to the flues *h*, while the flues *g* and *h* are connected together in pairs at the top as shown in dotted lines. By this arrangement all the pairs of flues *g*, *h* of one heating wall are arranged in parallel between a regenerator of one series and a regenerator of the other series. All the

regenerators are connected at each end with collector conduits *m*, which are used for exhausting the burnt gases. Each regenerator is also provided with a conduit *o* at each end which opens to the atmosphere, and valves *p* are provided for controlling the conduits *o* and *n*. The valves *p* are set so that cold air passes through the conduits *o* into the alternate regenerators at both ends, so that the air is heated in passing upwards through the regenerators to the combustion chambers. The hot burnt gases return downwards through the other set of regenerators as shown by the arrows, and pass by the conduits *n* to the collectors *m*. The setting of the valves *p* is periodically reversed in known manner. This arrangement ensures that the cold air entering the regenerators through the conduits *o* does not meet with any resistance due to sole flues or horizontal conduits, and the chimney draught has to overcome only the resistance due to the downward passage of the hot gases through the alternate regenerators. Further the gaseous currents through the main collectors *m* are always in the same direction, so that when the valve setting is reversed, there is no loss of heat due to the expulsion of large volumes of hot gas from the conduits. This arrangement is suitable for a battery of ovens burning a rich gas, but another arrangement comprising a pair of regenerators beneath each oven is also described for use with poor gas, such as producer or blast furnace gas.

NOTE.—Abstracts of the following specifications which are now accepted appeared in THE CHEMICAL AGE when they became open to inspection under the International Convention: 148,436 (F. Bergius) relating to manufacturing liquid organic compounds from coal, *see* Vol. III., p. 487; 149,317 (L. Lilienfeld) relating to producing viscous liquids from tar oils, *see* Vol. III., p. 543; 149,319 (L. Lilienfeld) relating to ethers of carbohydrates having the formula n ($C_6H_{10}O_5$), their conversion products and derivatives, *see* Vol. III., p. 543; 150,708 (Chemische Fabrik Röhm and Haas) relating to alkylene cyanhydrins, *see* Vol. III., p. 634; 149,001 (G. Muth) relating to aluminium sulphate, *see* Vol. III., p. 518; 154,182 (P. W. Webster and V. K. Boynton) relating to concentrating evaporating and dehydrating liquids, by treatment with gases, *see* Vol. IV., p. 165; 156,583. (Braden Copper Co.) relating to filtering, *see* Vol. IV., p. 377.

International Specifications not yet Accepted

169,451. PLASTIC COMPOSITIONS CONTAINING CONDENSATION PRODUCTS. Metropolitan-Vickers Electrical Co., Ltd., 4 Central Buildings, Westminster, London. (Assignees of H. C. P. Weber, 421, Locust Street, Edgewood Park, Pa., U.S.A.) International Convention date, September 24, 1920.

A substance having a fibrous base such as cellulose (*e.g.*, paper) is treated either successively or simultaneously with the reacting substances, so that condensation takes place within the fibres. The cellulose is preferably parchmentised by means of re-agents such as caustic soda, sodium, or ammonium zincate, stannates, stannites, antimonates, aluminates, or titanates, which also act as catalytic agents for the subsequent condensation. In an example, the parchmented material is passed through a bath of phenol, cresol, or other homologues, and is then treated with formaldehyde vapour. The process may be applied to other carbohydrates such as sugar or starch, and instead of formaldehyde, trioxymethylene, hexamethylene tetramine, or other substances with an active methylene group may be used.

169,460. DYES. Akt.-Ges. für Anilin Fabrikation, Treptow, Berlin. International Convention date, April 22, 1915.

The process is for obtaining acridine dyes. A formyl derivative of a *m*-diamine of the benzene series is heated with β-naphthylamine, or formyl-β-naphthylamine is heated with a *m*-diamine of the benzene series or a monoalkylated or unsymmetrically dialkylated *m*-diamine of the benzene series. Examples are given of dyestuffs which dye leather yellow to orange-red shades and are prepared from (1) 4-formylamino-2-aminotoluene and β-naphthylamine hydrochloride. (2) Monoformyl-*m*-phenylene-diamine and β-naphthylamine hydrochloride. (3) Formyl-β-naphthylamine and *m*-toluylene-diamine hydrochloride. (4) Formyl-β-naphthylamine and 3-amino-dimethylaniline hydrochloride. At least one molecular proportion of acid must be present for each molecular proportion of dyestuff produced.

169,687. DYES AND INTERMEDIATE PRODUCTS. Soc. Chimique de la Grande-Paroisse, 13, Rue des Saussaies, Paris. International Convention date, September 30, 1920.

A mixture of trinitronaphthol 1 : 2 : 4 : 8 or trinitronaphthol 1 : 2 : 4 : 5 or both, with alkali polysulphides, is heated to produce sulphuretted dyes which dye cotton reddish-brown shades. The sulphurising agent may be a mixture of sodium sulphide and sulphur. To produce the trinitronaphthols, naphthalene is nitrated, and the dinitronaphthalenes are heated with sulphuric acid and dilute nitric acid in succession.

169,688. AROMATIC NITROAMINES. Soc. Chimique de la Grande-Paroisse, 13, Rue des Saussaies, Paris. International Convention date, September 30, 1920.

1 : 2 : 4-chlor-dinitrobenzene is slowly added at 125°-130°C. to ammonium acetate obtained by saturating acetic acid of 80-95 per cent. with dry ammonia, and the mixture heated under a reflux condenser. The ammonium acetate is regenerated by passing ammonia gas into the mixture. The mixture is filtered, and 2 : 4 : dinitraniline is obtained. The liquor may be used again. Other aromatic nitroamines such as 1 : 3-diamino-4 : 6-dinitro-benzene, 1-chlor-4-amino-3 : 5-dinitrobenzene, 1-chlor-2 : 4-diamino-3 : 5-dinitrobenzene, 1 : 2-dichlor-4-amino-5-nitrobenzene, 1-amino-2-chlor-4-nitrobenzene, 1-amino-4-chlor-2-nitrobenzene, and *o*-nitroaniline may be similarly prepared from the chloro derivatives.

169,722. PURIFYING TANNINS. Byk-Guldenwerke Chemische Fabrik Akt.-Ges., 4, Neue Wilhelm Strasse, Berlin. International Convention date, October 1, 1920.

Tannins are extracted from raw materials by acids and treated with sulphurous or hydrosulphurous acid, or other volatile reducing acid, and then with basic compounds such as magnesium oxide, hydroxide, or carbonate, or similar compounds of barium, strontium, or calcium The insoluble salts thus formed are washed with water or organic solvents, and then decomposed by acids or salts which give insoluble compounds with the bases employed. The tannin solution is finally evaporated.

LATEST NOTIFICATIONS.

171,347. Process for welding metals and alloys which possess no characteristic welding temperature. Moll-Werke Akt.-Ges. November 9, 1920.

171,360. Process for the manufacture of artificial leather. Claessen, C. November 6, 1920.

171,384. Method of, and apparatus for, cleaning cellulose solutions. Furst, K. November 11, 1920.

171,390. Process of producing low-boiling hydro-carbons suitable for motor fluid and for other purposes. Metamid, M. November 11, 1920.

171,391. Method of manufacturing a catalyst adapted for the production of acetone from acetic acid and for other reactions. Stockholms Superfosfat Fabriks Aktiebolag. November 9, 1920.

Specifications Accepted, with Date of Application

142,806. Resin from naphthas, manufacture of, Barrett Co. May 5, 1919.

145,802. Dyestuffs of the acridine series, Manufacture of. Akt.-Ges. für Anilin Fabrikation. April 22, 1915.

146,183. Distillation of tar, or the like, and other liquids, Process and apparatus for. A. Irinyi. November 25, 1918.

146,396. Concentrating ores by flotation, Apparatus for. E. Otsuka. December 30, 1917.

146,407. Nickel catalyst, Manufacture of. H. Berger. November 10. 1916.

151,259. Alumina from aluminium nitrate solutions, Process for the production of. Norske Aktieselskab for Elektrokemisk Industri-Norsk, Industri-Hypotekbank. September 19, 1919.

155,226. Coke, Manufacture of. Barrett Co. December 19, 1919.

170,874. Artificial silk, Manufacture of. E. Bronnert. April 30, 1920.

170,880. Sulphuric acid, Manufacture of. A. Matheson. May 6, 1920.

170,908. Hydrogen, Production of. A. R. Griggs. July 10, 1920.

Applications for Patents

Barrett Co. Process for purification of hydro-carbons. 30,471 November 15 (United States, December 15, 1920).

British Scientific Instrument Research Association. Manufacture of abrasives. 30,483. November 15.

Clavel, R. Treatment of cellulose derivatives. 30,945, 30,946. November 19.

Imray, O. Y. and Society of Chemical Industry, Basle. Manufacture of derivatives of dihydro-isoquinoline. 30,612. November 16.

Lodge Fume Co., Ltd. (Möller). Separating suspended particles from gases, &c. 30,625. November 16.

Metallbank und Metallurgische Ges. Method for working electrical gas-purifiers. 30,461. November 15.

Willis, N. E. Chemical fire-extinguishing apparatus. 30,816. November 18.

Market Report and Current Prices

Our Market Report and Current Prices are exclusive to THE CHEMICAL AGE, *and, being independently prepared with absolute impartiality by Messrs. R. W. Greeff & Co., Ltd., and Messrs. Chas. Page & Co., Ltd., may be accepted as authoritative. The prices given apply to fair quantities delivered ex wharf or works, except where otherwise stated. The weekly report contains only commodities whose values are at the time of particular interest or of a fluctuating nature. A more complete report and list are published once a month. The current prices are given mainly as a guide to works managers, chemists, and chemical engineers; those interested in close variations in prices should study the market report.*

Market Report

LONDON, November 24, 1921.

There is a fair demand for chemicals, and on the whole prices are inclined to be firmer. Continental makers generally are sold out for this year, and quite a scarcity is developing in a number of directions. The export demand is only fair.

General Chemicals

ACETONE is again firm in price; stocks are in steady demand.

ACID ACETIC.—The first-hand position is very much firmer, and with the realisation of certain stocks a higher parity of prices is likely.

ACID CITRIC remains uninteresting.

ACID FORMIC is in rather better demand and stocks are firmly held.

ACID OXALIC is firmer in price, but business is of the hand-to-mouth variety.

ACID TARTARIC is slow of sale, and the tendency is uncertain.

ARSENIC remains in good demand, and is a rising market.

BICHROMATES.—Business has been rather quieter, and secondhand realisation has been a disturbing feature.

BLEACHING POWDER remains stagnant, and the tendency remains in buyers' favour.

COPPER SULPHATE is featureless, owing to the absence of export business.

FORMALDEHYDE remains a steady market; price unchanged.

IRON SULPHATE is only a slow market; price nominally unchanged.

LEAD ACETATE is in very poor demand, and the price is still drooping.

LEAD NITRATE is unchanged.

LITHOPONE.—Business remains small, but if anything prices are better.

POTASSIUM CARBONATE and POTASSIUM CAUSTIC are unchanged.

POTASSIUM CHLORATE.—Much better business has been passing, and the price is firmer.

POTASSIUM PRUSSIATE is in short supply; prices show an upward tendency.

SODIUM ACETATE.—Business has been a little better, with no appreciable change in price.

SODIUM CAUSTIC is still in active export enquiry, but the limits which are now going through are impracticable.

SODIUM NITRITE.—There is a small business from stock; prices are inclined to harden.

SODIUM PRUSSIATE is in strong demand, and a further advance in price is not unlikely.

Coal Tar Intermediates

Business continues on quiet lines, and prices remain in buyers' favour. The export market has shown a little more interest during the past week than has been the case recently.

ALPHA NAPHTHOL continues in quiet request at recent figures.

ALPHA NAPHTHYLAMINE is a quiet market without change in price.

ANILINE OIL AND SALT continue in considerable demand, and prices show a slight upward tendency.

BENZIDINE BASE is quiet.

BETA NAPHTHOL remains in full supply at recent values.

DIMETHYLANILINE is unchanged.

DIPHENYLAMINE continues firm, and has shown interest on export account.

NITROBENZOL is in steady supply at last quoted values.

PARANITRANILINE is firm, and has been enquired for on export account.

RESORCIN is slightly more interesting.

Coal Tar Products

The market generally is fairly active but somewhat irregular.

90 PER CENT. BENZOL is rather more freely offered, but there is no change in price.

PURE BENZOL is still quoted at 3s. 6d. to 3s. 8d. on rails in the Midlands and 4s. in London.

CREOSOTE OIL remains weak, with a downward tendency, and to-day's prices cannot be put at above 6d. to 6½d. in the North and 6½d. to 7d. in the South.

CRESYLIC ACID is fairly steady, without change of price.

SOLVENT NAPHTHA.—There is more enquiry, but only on a moderate scale. To-day's values are 2s. 6d. to 2s. 7d. per gallon in the Midlands and 2s. 11d. to 3s. in London.

NAPHTHALENE remains dull, with nothing of interest to report.

PITCH.—The market is weak and decidedly irregular. To-day's values are about 42s. 6d. to 45s., f.o.b., London, and 37s. 6d. to 40s., f.o.b., Hull.

Sulphate of Ammonia

The market remains steady without change of price. The home trade is less active, but there is a good demand for export.

Current Prices

Chemicals

	per	£	s.	d.		£	s.	d
Acetic anhydride	lb.	0	2	1	to	0	2	2
Acetone oil	ton	87	10	0	to	90	0	0
Acetone, pure	ton	90	0	0	to	95	0	0
Acid, Acetic, glacial, 99-100%	ton	60	10	0	to	62	10	0
Acetic, 80% pure	ton	45	0	0	to	48	0	0
Arsenic	ton	95	0	0	to	100	0	0
Boric, cryst	ton	65	0	0	to	68	0	0
Carbolic, cryst. 39-40%	lb.	0	0	6½	to	0	0	7
Citric	lb.	0	2	5	to	0	2	6
Formic, 80%	ton	65	0	0	to	67	10	0
Gallic, pure	lb.	0	3	10	to	0	4	0
Hydrofluoric	lb.	0	0	8½	to	0	0	9
Lactic, 50 vol	ton	40	0	0	to	43	0	0
Lactic, 60 vol	ton	43	0	0	to	45	0	0
Nitric, 80 Tw	ton	38	0	0	to	40	0	0
Oxalic	lb.	0	0	8½	to	0	0	9
Phosphoric, 1.5	ton	45	0	0	to	47	0	0
Pyrogallic, cryst	lb.	0	7	6	to	0	7	9
Salicylic, Technical	lb.	0	1	2	to	0	1	3
Salicylic, B.P.	lb.	0	1	6	to	0	1	8
Sulphuric, 92-93%	ton	8	0	0	to	8	10	0
Tannic, commercial	lb.	0	3	6	to	0	3	9
Tartaric	lb.	0	1	5	to	0	1	6
Alum, lump	ton	18	0	0	to	18	10	0
Alum, chrome	ton	37	10	0	to	40	0	0
Alumino ferric	ton	9	0	0	to	9	10	0
Aluminium, sulphate, 14-15%	ton	12	0	0	to	13	0	0
Aluminium, sulphate, 17-18%	ton	15	0	0	to	16	0	0
Ammonia, anhydrous	lb.	0	1	10	to	0	2	0
Ammonia, .880	ton	35	0	0	to	37	0	0
Ammonia, .920	ton	22	0	0	to	24	0	0
Ammonia, carbonate	lb.	0	0	4	to		—	
Ammonia, chloride	ton	60	0	0	to	65	0	0
Ammonia, muriate (galvanisers)	ton	45	0	0	to	47	10	0
Ammonia, nitrate	ton	55	0	0	to	60	0	0
Ammonia, phosphate	ton	90	0	0	to	95	0	0
Ammonia, sulphocyanide	lb.	0	3	0	to	0	3	0
Amyl acetate	ton	150	0	0	to	160	0	0
Arsenic, white, powdered	ton	42	0	0	to	44	0	0
Barium, carbonate, 92-94%	ton	12	10	0	to	13	0	0
Barium, chlorate	lb.	0	0	11	to	0	1	0
Chloride	ton	15	0	0	to	16	0	0
Nitrate	ton	42	10	0	to	45	0	0
Barium Sulphate, blanc fixe, dry	ton	26	0	0	to	28	0	0
Sulphate, blanc fixe, pulp	ton	16	0	0	to	16	10	0
Sulphocyanide, 95%	lb.	0	1	6	to	0	1	0

	Per	£	s.	d.		£	s.	d.
Bleaching powder, 35-37%	ton	14	0	0	to		—	
Borax crystals	ton	31	0	0	to	32	0	0
Calcium acetate, Brown	ton	8	0	0	to	9	0	0
" " Grey	ton	10	0	0	to	11	0	0
Calcium Carbide	ton	22	0	0	to	23	0	0
Chloride	ton	8	10	0	to	9	0	0
Carbon bisulphide	ton	60	0	0	to	62	0	0
Casein, technical	ton	85	0	0	to	90	0	0
Cerium oxalate	lb.	0	3	6	to	0	3	9
Chromium acetate	lb.	0	1	1	to	0	1	3
Cobalt acetate	lb.	0	11	0	to	0	11	6
Oxide, black	lb.	0	10	6	to	0	11	0
Copper chloride	lb.	0	1	3	to	0	1	6
Sulphate	ton	29	10	0	to	30	10	0
Cream Tartar, 98-100%	ton	130	0	0	to	135	0	0
Epsom salts (*see* Magnesium sulphate)								
Formaldehyde 40% vol	ton	88	0	0	to	90	0	0
Formusol (Rongalite)	lb.	0	3	9	to	0	4	0
Glauber salts, commercial	ton	5	5	0	to	5	10	0
Glycerine, crude	ton	70	0	0	to	72	10	0
Hydrogen peroxide, 12 vols	gal.	0	2	8	to	0	2	9
Iron perchloride	ton	35	0	0	to	40	0	0
Iron sulphate (Copperas)	ton	4	0	0	to	4	5	0
Lead acetate, white	ton	48	0	0	to	50	0	0
Carbonate (White Lead)	ton	43	0	0	to	46	0	0
Nitrate	ton	48	10	0	to	50	10	0
Litharge	ton	35	10	0	to	36	0	0
Lithopone, 30%	ton	26	0	0	to	28	0	0
Magnesium chloride	ton	12	0	0	to	13	0	0
Carbonate, light	cwt.	2	10	0	to	2	15	0
Sulphate (Epsom salts commercial)	ton	9	10	0	to	10	0	0
Sulphate (Druggists')	ton	15	10	0	to	17	10	0
Manganese, Borate	ton	70	0	0	to	75	0	0
Sulphate	ton	70	0	0	to	75	0	0
Methyl acetone	ton	85	0	0	to	90	0	0
Alcohol, 1% acetone	ton	105	0	0	to	110	0	0
Nickel sulphate, single salt	ton	65	0	0	to	66	0	0
Nickel ammonium sulphate, double salt	ton	67	0	0	to	68	0	0
Potash, Caustic	ton	33	0	0	to	33	10	0
Potassium bichromate	lb.	0	0	7¾	to		—	
Carbonate, 90%	ton	31	0	0	to	33	0	0
Chloride 80%	ton	15	0	0	to	20	0	0
Chlorate	lb.	0	0	5	to	0	0	5½
Meta bisulphite, 50-52%	ton	120	0	0	to	125	0	0
Nitrate, refined	ton	45	0	0	to	47	0	0
Permanganate	lb.	0	1	2	to	0	1	4
Prussiate, red	lb.	0	2	4	to	0	2	6
Prussiate, yellow	lb.	0	1	2½	to	0	1	3
Sulphate, 90%	ton	20	0	0	to	22	0	0
Salammoniac, firsts	cwt.	3	5	0	to		—	
Seconds	cwt.	3	0	0	to		—	
Sodium acetate	ton	28	0	0	to	30	0	0
Arsenate, 45%	ton	45	0	0	to	48	0	0
Bicarbonate	ton	10	10	0	to	11	0	0
Bichromate	lb.	0	0	6½	to	0	0	7
Bisulphite, 60-62%	ton	25	0	0	to	27	10	0
Chlorate	lb.	0	0	4¾	to	0	0	5
Caustic, 70%	ton	24	0	0	to	24	10	0
Caustic, 76%	ton	25	10	0	to	26	0	0
Hydrosulphite, powder, 85%	lb.	0	2	3	to	0	2	6
Hyposulphite, commercial	ton	15	0	0	to	16	0	0
Nitrite, 96-98%	ton	40	0	0	to	42	0	0
Phosphate, crystal	ton	23	10	0	to	25	10	0
Perborate	lb.	0	1	6	to	0	1	7
Prussiate	lb.	0	0	8½	to	0	0	9
Sulphide, crystals	ton	17	0	0	to	18	0	0
Sulphide, solid, 60-62%	ton	24	10	0	to	25	10	0
Sulphite, cryst	ton	15	0	0	to	16	0	0
Strontium carbonate	ton	80	0	0	to	85	10	0
Strontium Nitrate	ton	70	0	0	to	72	10	0
Strontium Sulphate, white	ton	7	10	0	to	8	10	0
Sulphur chloride	ton	41	0	0	to	42	0	0
Sulphur, Flowers	ton	13	0	0	to	14	0	0
Roll	ton	13	0	0	to	14	0	0
Tartar emetic	lb.	0	1	6	to	0	1	7
Tin perchloride, 33%	lb.	0	1	2	to	0	1	4
Tin perchloride, solid	lb.	0	1	5	to	0	1	7
Protochloride (tin crystals)	lb.	0	1	5	to	0	1	6
Zinc chloride, 102 Tw	ton	21	0	0	to	22	10	0
Chloride, solid, 96-98%	ton	50	0	0	to	55	0	0
Oxide, 99%	ton	40	0	0	to	42	0	0
Dust, 90%	ton	47	10	0	to	50	0	0
Sulphate	ton	21	10	0	to	22	10	0

Coal Tar Intermediates, &c.

	Per	£	s.	d.		£	s.	d.
Alphanaphthol, crude	lb.	0	3	3	to	0	3	6
Alphanaphthol, refined	lb.	0	3	9	to	0	4	0
Alphanaphthylamine	lb.	0	2	6	to	0	2	8
Aniline oil, drums extra	lb.	0	1	5	to	0	1	6
Aniline salts	lb.	0	1	6	to	0	1	7
Anthracene, 40-50%	unit	0	0	3½	to	0	0	9
Benzaldehyde (free of chlorine)	lb.	0	4	0	to	0	4	6
Benzidine, base	lb.	0	6	0	to	0	6	6
Benzidine, sulphate	lb.	0	6	6	to	0	7	0
Benzoic acid	lb.	0	2	0	to	0	2	3
Benzoate of soda	lb.	0	2	0	to	0	2	3
Benzyl chloride, technical	lb.	0	2	0	to	0	2	6
Betanaphthol benzoate	lb.	0	5	9	to	0	6	0
Betanaphthol	lb.	0	2	3	to	0	2	0
Betanaphthylamine, technical	lb.	0	9	0	to	0	9	6
Croceine Acid, 100% basis	lb.	0	4	6	to	0	5	6
Dichlorbenzol	lb.	0	0	9	to	0	0	10
Diethylaniline	lb.	0	6	9	to	0	7	0
Dinitrobenzol	lb.	0	1	5	to	0	1	6
Dinitrochlorbenzol	lb.	0	1	5	to	0	1	6
Dinitronaphthaline	lb.	0	1	6	to	0	1	8
Dinitrotoluol	lb.	0	1	8	to	0	1	9
Dinitrophenol	lb.	0	2	9	to	0	3	0
Dimethylaniline	lb.	0	3	9	to	0	4	0
Diphenylamine	lb.	0	4	6	to	0	4	9
H-Acid	lb.	0	8	0	to	0	8	6
Metaphenylenediamine	lb.	0	5	6	to	0	5	9
Monochlorbenzol	lb.	0	0	10	to	0	1	0
Metanilic Acid	lb.	0	6	6	to	0	7	0
Monosulphonic Acid (2.7)	lb.	0	7	0	to	0	7	6
Naphthionic acid, crude	lb.	0	4	0	to	0	4	3
Naphthionate of Soda	lb.	0	4	3	to	0	4	6
Naphthylamin-di-sulphonic-acid	lb.	0	4	9	to	0	5	0
Nitronaphthalene	lb.	0	1	4	to	0	1	5
Nitrotoluol	lb.	0	1	3	to	0	1	4
Orthoamidophenol, base	lb.	0	18	0	to	1	0	0
Orthodichlorbenzol	lb.	0	1	1	to	0	1	2
Orthotoluidine	lb.	0	2	3	to	0	2	6
Orthonitrotoluol	lb.	0	0	10	to	0	1	0
Para-amidophenol, base	lb.	0	12	0	to	0	12	6
Para-amidophenol, hydrochlor	lb.	0	12	6	to	0	13	0
Paradichlorbenzol	lb.	0	0	7	to	0	0	8
Paranitraniline	lb.	0	4	6	to	0	4	9
Paranitrophenol	lb.	0	2	9	to	0	3	0
Paranitrotoluol	lb.	0	5	9	to	0	6	0
Paraphenylenediamine, distilled	lb.	0	12	0	to	0	13	0
Paratoluidine	lb.	0	7	0	to	0	7	6
Phthalic anhydride	lb.	0	3	9	to	0	4	0
Resorcin, technical	lb.	0	5	0	to	0	5	6
Resorcin, pure	lb.	0	8	0	to	0	8	3
Salol	lb.	0	2	6	to	0	2	9
Sulphanilic acid, crude	lb.	0	1	4	to	0	1	6
Tolidine, base	lb.	0	6	6	to	0	7	0
Tolidine, mixture	lb.	0	2	6	to	0	2	9

French Potash

THE prices as quoted during the past few months still prove attractive to buyers who require the lower grades of potash for immediate application. At the present time the Alsatian Mines are the chief suppliers to the United Kingdom.

Reports which have recently been received from Paris indicate that the Alsatian potash industry is to be protected at all costs. The duty on imported supplies has hitherto been very low, but as the production and manufacture of potash is now a great stand-by both to the agricultural and chemical industries of France, the tariff has had to be appreciably increased. The duty on muriate and sulphate of potash is now 30 frs. per 100 kilos as compared with 3 frs. before the war.

ILFORD, LTD.—A dividend of 8 per cent. is announced on the ordinary shares for the year to October 31 last.

ARIZONA COPPER CO.—A meeting has been called for November 28 to consider a resolution to reduce the capital to £715,000 by cancellation of the entire issue of "A" preference shares.

LEVER BROTHERS, LTD.—Dealings in 134,516 20 per cent. preferred ordinary shares of 5s. each, fully paid, Nos. 5,865,485 to 6,000,000, have been specially allowed by the Stock Exchange Committee under Rule 148a. These securities will rank *pari passu* with those in which special settling days have already been appointed, as soon as they are identical and the certificates are ready for distribution, and with those for which an official quotation has already been granted as soon as they are identical and are officially quoted.

German Chemical Market

FROM OUR OWN CORRESPONDENT

Berlin, November 14, 1921.

THE violent plunge of the German mark has resulted in a sharp rise in prices of chemical products, almost doubling the quotations of the previous month. In spite of this, however, heavy buying continues with extremely large export orders, and stocks of many products have been depleted to vanishing point. As a result of this there has been an acute shortage of supplies for domestic use. It was, for instance, practically an impossibility to obtain caustic soda, caustic potash, and soda sulphide, as stocks were absolutely exhausted by foreign purchasers. The following statement gives some idea of the difference between quotations in September and October:

	Inland. Marks per kilog.		Export. Marks per kilog.	
	Sept.	Oct.	Sept.	Oct.
Caustic potash 88 — 92 per cent.	10	18.50	13	19.75
Caustic potash liquid 50° Bé	4.45	8.75	7.50	—
Caustic soda 125 — 128°	9	17	10	18.50
Magnesium chloride, fused	1.55	—	3.20	4
Potash carbonate 96 — 98 per cent.	8.60	16.50	12	17.50
Soda sulphide 30 — 32 per cent.	5.50	—	5.50	18
Zinc white, Red-Seal	12	19	14	23

Oils and fats are similarly affected, the market suffering from similar conditions. Increases in quotations are shown in the following table:

	September. Marks per kilog.	October. Marks per kilog.
Castor oil	21.50	36.50
Cod-liver oil, yellow	15.50	19
Coconut-oil, fatty, acid	22.50	30
Linseed oil	18	24
Turpentine, American	29	46
,, Swedish	19	31
Skin glue	26.50	35

Conditions of late have become steadily worse, and no improvement in the situation may be looked for; further developments even indicate a rapidly approaching crisis.

There is a constant demand for oxalic acid, but only small lots are on offer. Alum is in brisk demand with no offerings, and barium chloride has been inquired for both for home and export requirements. There are small offerings of bleaching powder. Large orders have been placed for borax for domestic consumption, but scarcity of stocks prevented execution, and prices hardened appreciably. Comparatively small lots of calcium chloride have been offered for export. Export inquiry has been very strong for copper sulphate, but stocks were insufficient to meet all demands. There has been a brisk demand for potassium cyanide and sodium cyanide for abroad, but as German manufacturers are supplying export requirements direct, there have been practically no supplies on the market, and business has been purely nominal. Potassium bichromate has been offered, but there is little inquiry for this product; potassium carbonate, 96 — 98 per cent., is available in fairly large quantities, but very little business is reported. Caustic potash, 88 — 92 per cent., has been in brisk demand with small stocks on offer, and the liquid variety, 50° Bé, has become very scarce. Chlorate of potash is also scarce, there having been no recent offerings. Potassium metabisulphite has hardened recently on account of increases in manufacturing costs, and a further increase in price may be anticipated. A number of export enquiries for soda ash are reported, but stocks available for shipment are low.

Birmingham Technical School

AT the distribution of prizes to the students of the Birmingham Technical School on November 16, Dr. Sumptner (the Principal) announced that donations had been given or promised by SEVERAL CHEMICAL FIRMS for the purpose of equipping a research laboratory for the Chemical Department.

Company News

PREMIER PORTLAND CEMENT CO. (RHODESIA).—The directors announce a further dividend of 10 per cent.

CASSEL CYANIDE CO.—A further dividend of 8d. per share is announced, making 1s. per share for the year, less tax.

LAGUNAS SYNDICATE, LTD.—A report of the annual meeting, held in London on Tuesday, appears on page 672.

SANTA CATALINA NITRATE CO., LTD.—A report of the annual meeting, held in London on Tuesday, appears on p. 670.

ILFORD, LTD.—The transfer books of the ordinary shares are closed from November 21 to December 7, both days inclusive.

SALINAS OF MEXICO.—Interest Coupon No. 30 of the 5 per cent. first mortgage participating debentures will be paid on and after December 1 by the Bank of Liverpool and Martin's, Ltd., 68, Lombard Street, London, E.C.

BROKEN HILL PROPRIETARY, BLOCK 14.—A cabled advice having reference to the report and accounts for the half-year to September 30 last has been received from the head office in Melbourne to the following effect: "Operations for half-year have resulted in a net loss; after providing for depreciation, of £7,248. Credit balance to profit and loss account carried forward, £22,194. The assets show a surplus of £19,645, not including shares in other companies." Copies of reports and accounts should be in hands of shareholders on London register about the end of next month.

BRITISH COTTON AND WOOL DYERS.—For the half year to September 30 last the profits, after charging specific depreciation, £5,570, and repairs and renewals, £31,686, amounted to £4,629. After making the usual charges and transferring to depreciation fund (which now stands at £152,500) £12,500, there is a loss of £21,002. The amount brought forward was £21,599, leaving a credit balance of £597. The directors state that no adjustment has been made in regard to excess profits duty, but on final settlement a considerable sum should come to credit of the accounts.

SANTIAGO NITRATE CO.—The accounts for the year to June 30 last show a gross profit of £29,308. After deducting income tax, London charges, and provision for stoppage expenses, there remains £15,198, and £5,973 was brought in making £21,171. From this is deducted a dividend at the rate of 7½ per cent., less tax, for the year, leaving to be carried forward £9,171. Owing to the condition of the nitrate market, the oficina was closed on April 20 last. The annual meeting will be held at 10, Lime Street, London, E.C., on November 28, at 12.30 p.m.

ANGLO-BURMA OIL CO., LTD.—A Stock Exchange announcement states that dealings in 200,070 shares of 2s. each, fully paid, Nos. 1 to 200,070; and 3,000,000 shares of 2s. each, 1s. paid, Nos. 200,071 to 3,000,000 and 4,000,001 to 4,200,070, have been specially allowed by the Committee under Rule 148a. These securities will rank *pari passu* with those in which special settling days have already been appointed, as soon as they are identical and the certificates are ready for distribution, and with those for which an official quotation has already been granted as soon as they are identical and are officially quoted.

WEARDALE LEAD CO.—The report for the year to September 30 last states that a heavy fall in the price of lead early in the year made it essential to curtail operations, as it was impossible at that time to secure a corresponding decrease in working costs. The coal mines stoppage which followed made it necessary to close the company's mines for twelve weeks. The accounts show a deficit of £3,287 carried to balance-sheet. An early return to profitable working is looked for. The directors regret the results do not warrant the declaration of a dividend, which they point out is the first occasion of the kind during the last sixteen years.

LIVERPOOL NITRATE CO.—The profit for the year ended June 30 last was £113,843 (against £126,997 in the previous year), while £34,075 was brought forward, making £147,918. It is proposed to pay a final dividend of 2s. 6d. per share, less tax, making 5s. per share, less tax, for the year (as compared with 7s. per share, free of tax). The Oficina Carmen Bajo remains closed, while Oficinas Ramirez and Buena Ventura ceased to manufacture nitrate in December, 1920; Oficina San Donato in April; and Mapocho in May, 1921. Oficina San Lorenzo stopped producing nitrate in September, 1920, but the Maquina is now being remodelled. The annual meeting was held on Thursday at the Law Association Rooms, Cork Street, Liverpool.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

London Gazette

Bankruptcy Information

BOWMAN, Alexander, Lowther Arcade, and 1, Rickergate, both Carlisle, drug store proprietor. First meeting, November 30, 3 p.m., 34, Fisher Street, Carlisle.

CHEETHAM, Reginald Spencer, 48, Bridge Street, Peterborough, druggist. First meeting, December 2, 12.15 p.m., and public examination, 11 a.m., Law Courts, Peterborough.

Company Winding Up

TAR BURNERS, Ltd. First meetings on November 29, at 33, Carey Street, London, W.C. 2; creditors, 11.30 a.m., and contributories, 12 noon.

Liquidator's Notice

OILS AND GREASES, Ltd. (In voluntary liquidation). General meeting of members, 10, Bush Lane, Cannon Street, London, E.C. 4, Thursday, December 22, at 3 p.m., to receive the liquidator's final report of winding-up.

County Court Judgments

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for damages or otherwise, and the result of bona-fide contested actions. But the Registry makes no distinction of the cases. Judgments are not returned to the Registry if satisfied in the Court books within twenty-one days. When a debtor has made arrangements with his creditors we do not report subsequent County Court judgments against him.]

HICKS MILLS ELSWORTHY & CO., LTD., 297, Haydens Road, Wimbledon, London, chemical manufacturers. £20 2s. 9d. October 7.

JAMESON, L., & CO., 83, Queen Victoria Street, London, E.C., chemists. £22 17s. 6d. October 10.

LUREY, Leopold, 202, North Street, Leeds, chemist. £23 3s. 6d. October 5.

MACDIARMID, William Tullich, 82, Mark Lane, London, chemical manufacturer. £16 9s. 10d. October 4.

MAYFIELD COLOUR & CHEMICAL CO., 17-21, Stove Street, Ardwick, Manchester, colour merchants. £39 8s. 4d. October 4.

ROLLASON, Bert, 13, Coney Green Drive, Longbridge Estate, Northfield, Birmingham, chemist. £30 2s. 3d. October 12.

RUSSELL, G. H., 33, High Street, Willesden, chemist. £18 8s. 6d. October 10.

Mortgages and Charges

*[NOTE.—The Companies Consolidation Act, of 1908, provides that every Mortgage or Charge, as described therein, created after July 1, 1908, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges which would, if created after July 1, 1908, require registration. The following Mortgages and Charges have been so registered. In each case the total debt, as specified, in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced since such date.]*

BRITISH CELLULOSE & CHEMICAL MANUFACTURING CO., LTD. (late British Cellulose & Chemical Manufacturing (Parent) Co., Ltd.), London, S.W.—Registered November 9, £10,000 and £10,000 debentures part of £500,000; general charge. *Nil. December 23, 1920.

CHALK FUEL, POWER GAS, & BYE PRODUCTS CORPORATION, LTD., London, E.C. Registered November 10, £474 10s. of debentures, to Saward Baker & Co., Ltd., 27, Chancery Lane, W.C., advertising agents; general charge. *Nil. June 7, 1920.

ELTON COP DYEING CO., LTD., Bury. Registered November 7, mortgage collateral to mortgage registered August 12, 1919, securing £30,000, to Rt. Hon. M. A. de Trafford and others; charged on land at Elton. *£30,000. August 10, 1920.

EVANS (C.), LTD. (late East Manchester Drug Co., Ltd.). Registered November 7, mortgaged to National Provincial & Union Bank of England, Ltd., securing all moneys due or to become due to the Bank; charged on 839 Ashton Old Road, Openshaw. *Nil. December 31, 1920.

LEADLESS WHITE MANUFACTURING CO., LTD., London, E.C., colour, &c., manufacturers. Registered November 11, £3,000 debentures part of amount already registered; charged on property at Yate, also general charge.

NORTH EASTERN CHEMICAL CO., LTD., London, E.C. Registered November 5, £10,000 debentures; general charge. *£10,000. February 23, 1920.

PARKER & LESTER, LTD., London, S.E., varnish, colour, and paint manufacturers. Registered November 11, £500 debentures; general charge. *——. February 14, 1920.

PREMIER DYEING & FINISHING CO., LTD., Leek. Registered November 4, £9,000 debentures; general charge. *£800. March 9, 1921.

Satisfactions

EASTMAN & SON (DYERS AND CLEANERS), LTD., London, W. Satisfaction registered November 8, £100,000 (not exceeding), registered March 22, 1918.

JEFFERY (HAMMOND) & CO., LTD., London, E.C., manufacturing chemists, &c. Satisfaction registered November 12, £200, registered July 25, 1916.

NORTH EASTERN CHEMICAL CO., LTD., London, E.C. Satisfaction registered November 5, £10,000, registered between August 8, 1916, and November 14, 1918.

PREMIER DYEING & FINISHING CO., LTD., LEEK. Satisfaction registered November 11, £800, balance of amount registered October 16, 1915.

New Companies Registered

The following list has been prepared for us by Jordan & Sons, Ltd., company registration agents, 116 and 117, Chancery Lane, London, W.C.2:—

AMALGAMATED OIL AREAS, LTD., 14, Mansion House Chambers, E.C. 4. Incorporated in Jersey, Channel Islands. To acquire all kinds of oil-bearing lands and carry on the business of dealers and refiners of mineral oils and products thereof. Nominal capital, £200,000 in 200,000 shares of £1 each. Directors: F. P. Hawkins, F. Naylor. Name of person authorised to accept service, Frederick Naylor, accountant, 38, Ringstead Road, Catford, S.E. 6.

EDEN OIL SYNDICATE, LTD., 1, Gresham House, Old Broad Street, E.C. 2. To develop any oil-bearing lands and manufacture and prepare for market petroleum and other mineral oils. Nominal capital, £1,000 in 20,000 shares of 1s. each. Directors: to be appointed by subscribers. Qualification of directors, 1 share.

METALLURGICAL RESEARCH, LTD. To acquire patents in relation to treatment, development, and production of chemicals, minerals, and metals, and turn same to account. Nominal capital, £100 in 2,000 shares of 1s. each. Directors: to be appointed by subscribers. Qualification of directors, 10 shares. Subscribers: A. Goodwin, A. G. Skipp.

MOTHERSILL REMEDY CO., LTD., 19, St. Bride Street, E.C. 4. Incorporated in Quebec, Montreal, Canada. Wholesale and retail druggists and to manufacture patent medicines. Nominal capital, 175,000 dollars into 100 dollar shares. Name of person authorised to accept service, Walter Heron Gerson.

PEERLESS REFINING COMPANY (LIVERPOOL), LTD., 9, Mawdsley Street, Bolton, producers and refiners of edible fats. Nominal capital, £7,000 in 6,000 ordinary shares of £1 each and 1,000 deferred ordinary shares of £1 each. Directors: to be appointed by subscribers. Qualification of directors, £500.

POMMEROLS CURE, LTD., 72-74, Victoria Street, Westminster, S.W. 1, chemists and druggists. Nominal capital, £2,000 in 2,000 ordinary shares of £1 each. Directors: J. G. L. Pommerol, E. M. Howe, F. Hill, J. Melendri. Qualification of directors, 1 share. Remuneration of directors: to be voted by company in general meeting.